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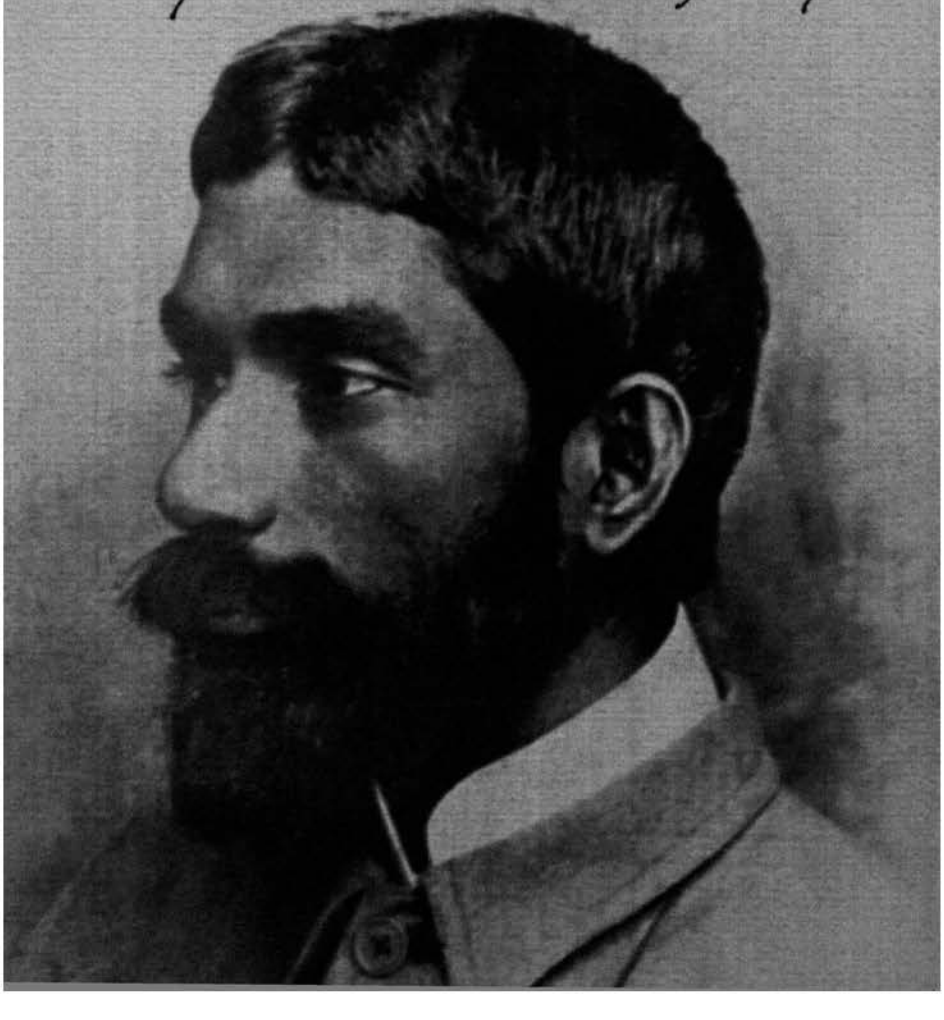
A CHECKLIST OF MAJOR HOLDINGS IN ENGLISH
AND BENGALI (WITH EDITED TEXTS IN SANSKRIT)

Edited by Swapan Chakravorty

Praphullachandra Ray



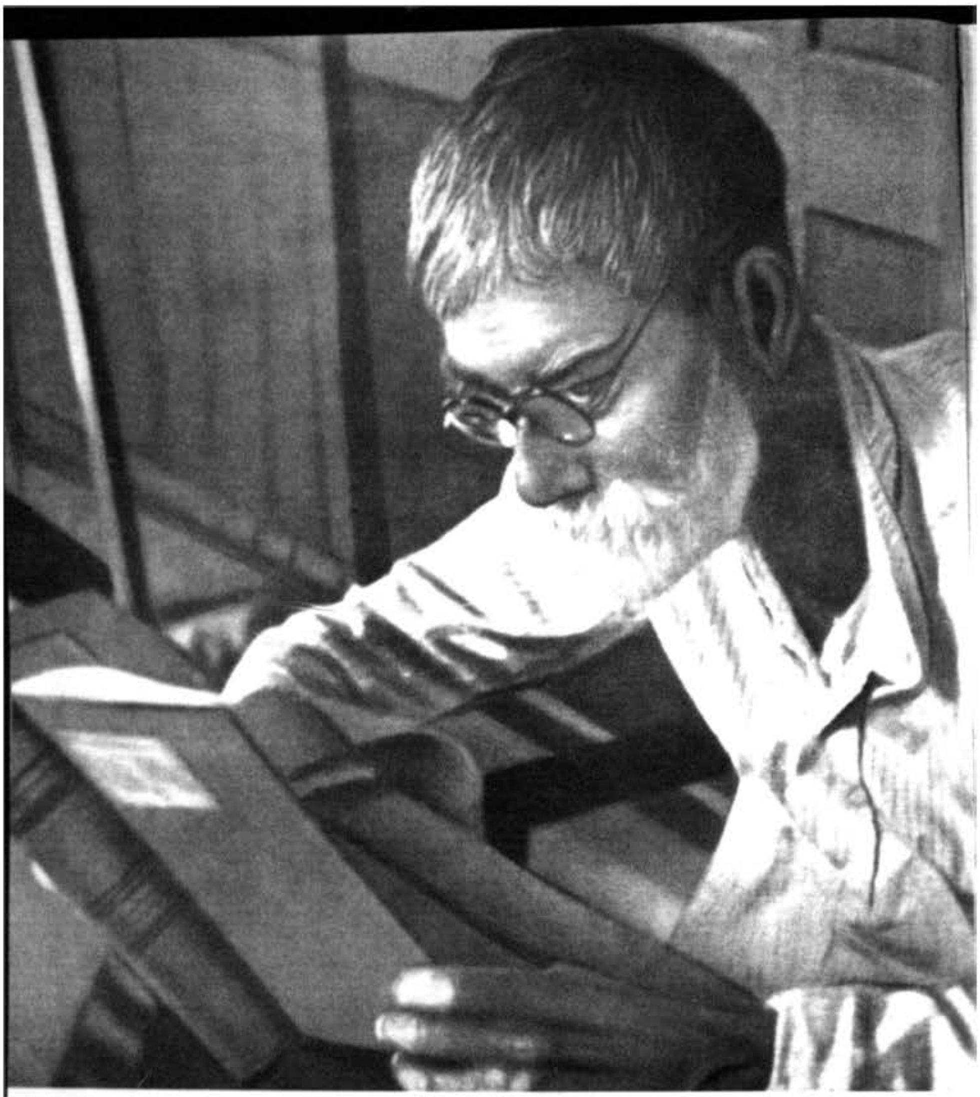
"India must wake up, shake off her degradation, put life and heart into every class of her people, elevate her women and depressed classes and remove the galling restrictions of caste and all social inequalities. When this is done she will enter into a new era of her life and then, like Prometheus unbound, she will be recognized as a great power in the world and will have an unique place in the comity of nations."

P. C. Ray, 'Social Reform in India', in *Essays and Discourses* (Chennai [Madras]: G. A. Nateson & Co., 1918), p. 235.

It says in the Upanishads that the Supreme One wanted to be many. The urge for self-dispersal is at the root of this creation. It was through this kind of creative urge that Prafulla Chandra became many in the minds of his pupils by diffusing and thereby reactivating himself in many younger minds.

Rabindranath Tagore

Acharya Praphullachandra Ray: Birth Centenary Souvenir Volume
(Kolkata: University of Calcutta, 1962), pp. 28-29



Ray engaged in reading Shakespeare (1916)

Photo taken by Parimal Goswami

PRAPHULLA CHANDRA RAY

A Checklist of Major Holdings
in English and Bengali
(with edited Texts in Sanskrit)
at the
National Library
Kolkata

Edited by
Swapan Chakravorty

NATIONAL LIBRARY
KOLKATA
GOVERNMENT OF INDIA

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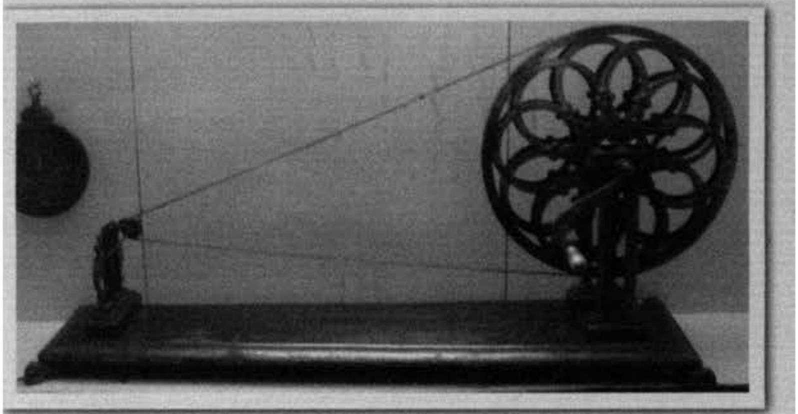
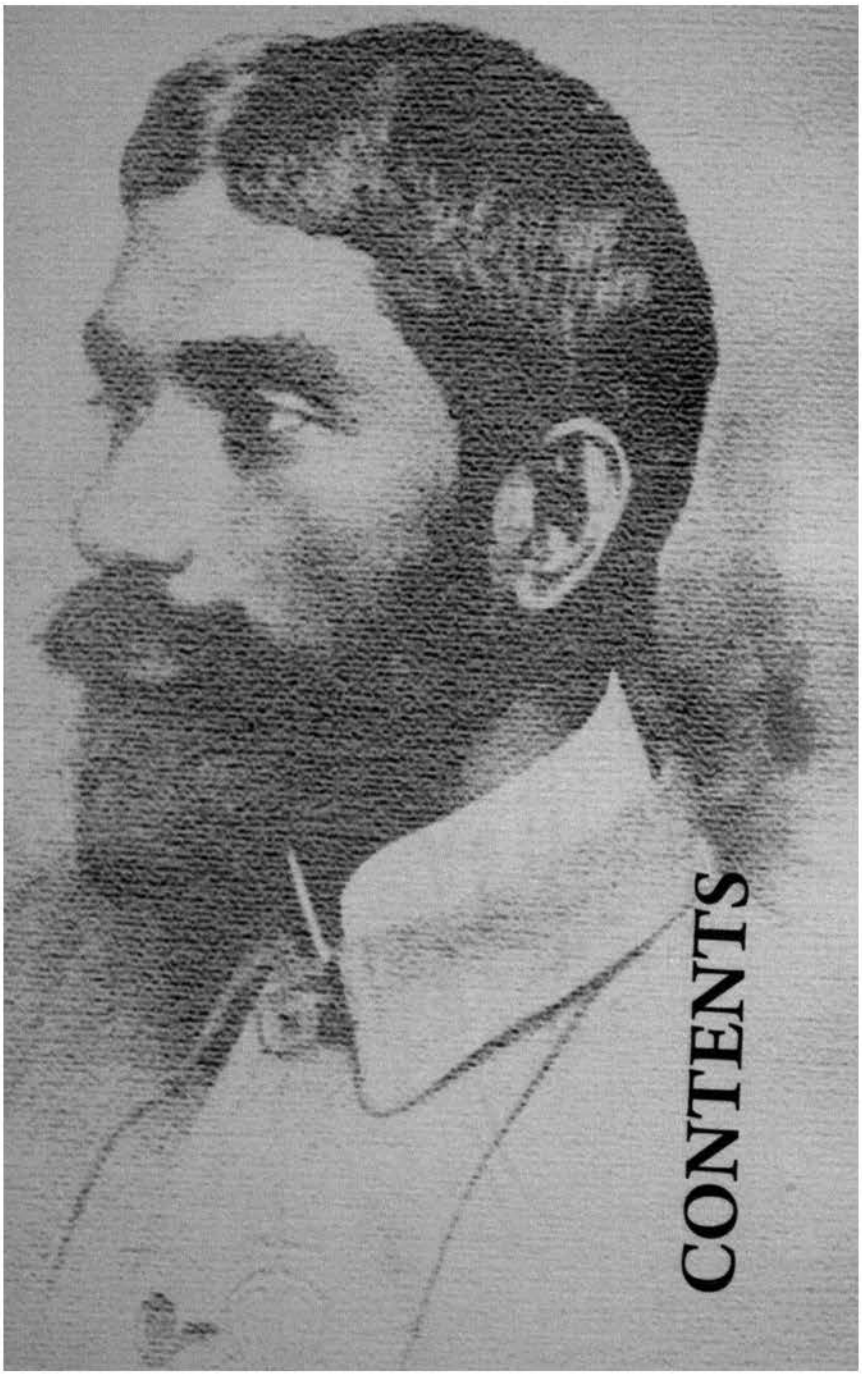


The charka was presented to Praphullachandra at a civic reception by Bidhanchandra Ray, Mayor of Kolkata, at a civic felicitation. (1932)

Courtesy: Bangiya-Sahitya-Parishat and Indrajit Chaudhuri.



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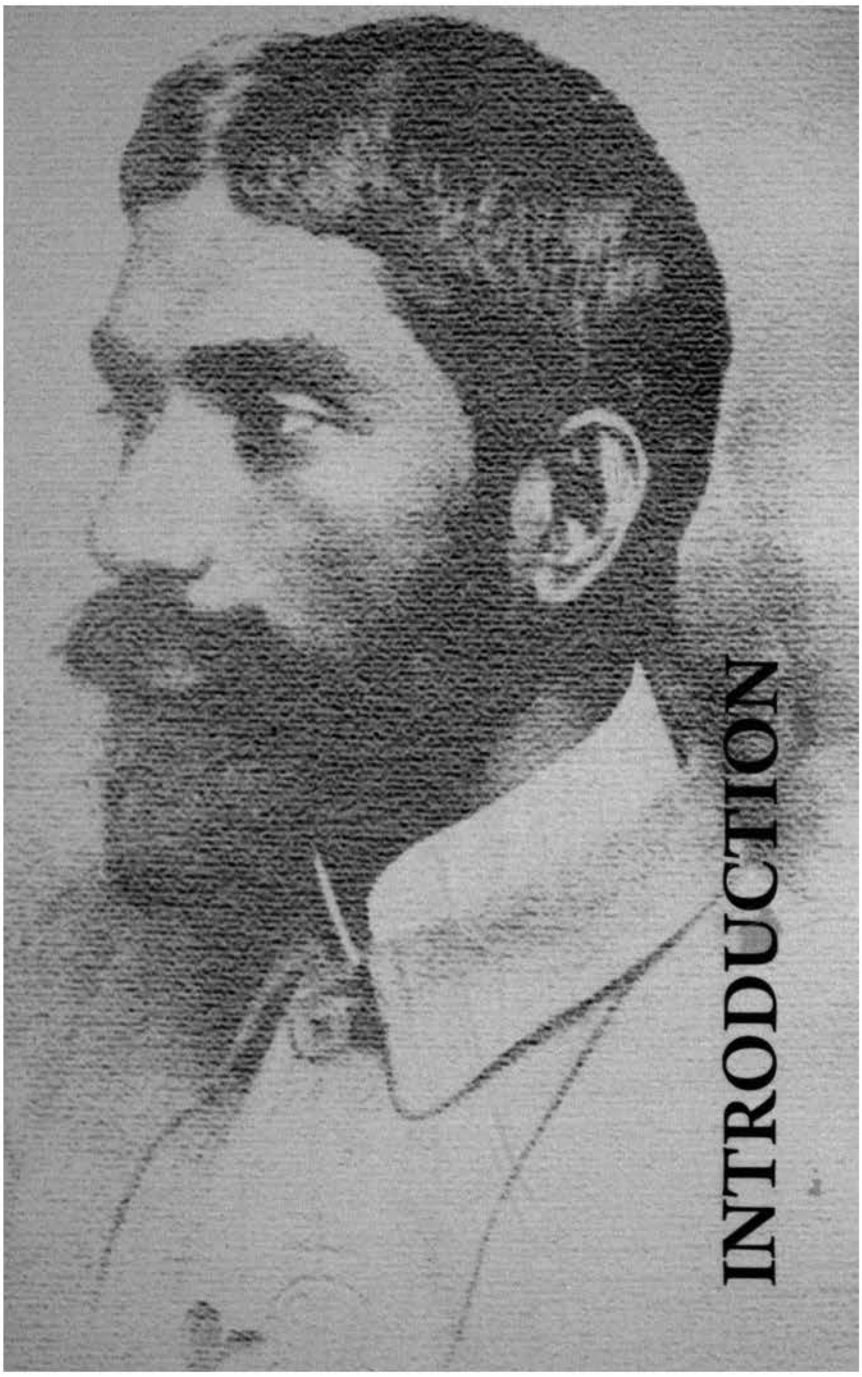


INTRODUCTION

There is a moving portrait of Praphullachandra (or Prafulla Chandra or Praphulla Chandra) Ray (1861-1944), a photograph taken very late in his life, in which the frail, bearded scientist is peering through thick glasses at a heavy book, held with some effort by infirm hands reflected on the glass top of the study table, with the veins of the wrists showing through his gauze-like skin. He seems unaware of the camera's presence, dressed in a shabby shirt, frayed at the edges. The hair is unbrushed, his grey beard and moustache are all over the place. The intensity of the reader's gaze is matched by the book's unrelenting weight. In another almost identical photograph the book held in his hands turns out to be a volume of Shakespeare's works.

One is strangely reminded of the many fifteenth- and sixteenth-century portraits, especially the one by Giovanni Bellini, of St Jerome reading in the wilderness—troubled, trapped inside a sad world of lonely prescience, so unlike, say, the relaxed, smoking, sociable portrait of Claude Monet as reader painted in 1872 by Pierre-Auguste Renoir. So arresting is the image that one forgets that this is a photograph of Praphullachandra Ray, the prophet who had tirelessly raged against an exclusive culture of reading. On 7 April 1918, Ray warned that observation and experiment, and not book-learning, were the sources of scientific knowledge. He cited the example of Kew Gardens, where the people of a country that sees sufficient sunlight for only three months a year, could observe plants from the tropics, nurtured in hothouses. He also alluded to the adventures of Joseph Dalton Hooker (1817-1911), who took back 10,000 botanical samples to England braving imprisonment in Sikkim, and was appointed Director of Kew. However, Ray was speaking at the annual meet of the Bali Public Library, and the necessity of the seeming paradox of secluded reading and experimental science could not have been better illustrated than by the venue and the occasion.

It comes as no surprise that Ray was one of the founders of Rammohan Library, a public institution funded by native benefactors, and was its President from 1938 to 1944. In addition, he set up the Bengal Chemical Steam Press and published some of the books printed. In 1910 Ray inspired three of his students Rameshchandra Chakravarti, Mukundalal Chakravarti and Ahindranath Chattopadhyay to start the successful publishing house Chuckervertty, Chatterjee and Company. Ray's involvement with the history of the printed book in Bengal merits more attention than it has received so far.

The reader in Ray resented the use of reading as the weapon of social exclusion. In *A History of Hindu Chemistry* (1903) the decline of scientific spirit and technical expertise is traced back to the caste system that reasserted itself with the end of Buddhist rule:

> In ancient India the useful arts and sciences, as distinguished from mere handicrafts, were cultivated by the higher classes. In the White Yajur-Veda and in the Taittiriya Brahmana, we meet with the names of various professions which throw light on the state of society of that period; unfortunately a knowledge of these perished with the institution of the caste system in its most rigid form.[1]

Sankara's doctrine of *maya*, its indifference to the material world as source of knowledge, made the path steeper for Indian science, and Indian logic acquired its fussy sophistication at the expense of the rigours of physical observation and induction.

Not just the protocol of science, commercial enterprise was also impeded by this culture of social discrimination. Reading in colonial Bengal, felt Ray, bred useless readers inimical to trade and manufacture. Even before Ray founded Bengal Chemical and Pharmaceutical Company (later Bengal Chemicals and Pharmaceuticals Limited), he started drying cattle bone on the terrace of his house on Upper Circular Road (the road now named after him) in order to make calcium superphosphate. This was unacceptable to his Hindu neighbours, and Ray had to shift the bones to a plot of land in Maniktala leased by a manufacturer of nitric acid. The bones were burnt there and the ash converted to phosphate of lime by the addition of sulphuric acid, and then by the reaction of soda to phosphate of soda, a chemical that had medicinal and laboratory uses. Bengal Chemical and Pharmaceutical Works Limited was formally incorporated in 1903. By 1944, the capital of the company started by its spartan founder had soared from 50,000 to 2.2 million rupees.[2]

A life of social action rooted in scientific training would eventually co-incide with a nationalist trajectory, at least in a colonial society. 'I can assure you, however,' he wrote to Chittaranjan (or Chitta Ranjan) Das's sister, '...that in serving my favourite science I have only one idea in my mind, namely, that through her I should serve my country.'[3] He would use Adolf von Baeyer's synthesizing of indigo in the late nineteenth century as an instance of the service to which inorganic chemistry could be put to relieve the misery of Indians. Baeyer's achievement freed millions of acres and peasants in Bengal from the oppressive grip of indigo planters. Yet Ray was not blind to the implications of the science for imperialist designs. He observed in the same essay that Germany would have surrendered much earlier than it did in the First World War had it not been for the discovery of the technique of synthesizing ammonia, and of its eventual conversion to nitric acid that went into the manufacture of explosives. The allied warships had denied Germany access to the saltpetre extracted in Chile. But Fritz Haber, who was head of the German Chemical Warfare Service during the War, had perfected the technique of synthesizing ammonia from nitrogen and hydrogen early in the twentieth century, enabling Germany to brave the embargo. Haber was the mastermind behind the mustard gas attacks on allied troops.[4]

Ray's involvement in the affairs of the Congress, his association with such leaders as Chittaranjan Das, Subhaschandra Basu (or Subhas Chandra Bose) and Mohandas Karamchand Gandhi, and his active contribution to relief work during famines and floods in Khulna and north Bengal in 1921-2 were clearly part of a broad nationalist project. What is not always so evident is that his commercial ventures were geared toward public benefit rather than the colonial trade. This was as true of the chemicals and drugs his firms produced, many of them from indigenous plants, as of the scientific programmes in which his leading students were engaged. Satischandra Dasgupta (1880-1979), for instance, designed an inexpensive fire extinguisher and made indigenous detergents. Later a follower of Gandhi, he would go on to write books on the simple processes of manufacturing ink, match-boxes and paper. Nilratan Dhar (1892-1986) experimented with the use of waste from sugar mills for the nitrification of soil. Bireschandra Guha (1904-1962) succeeded in enhancing the protein content and the proportion of ascorbic acid in the average Indian diet. Jnanendranath Mukhopadhyaya (1893-1983), who introduced the chemistry of colloids in India, also pioneered agricultural science and founded the Indian Society of Soil Science in 1934. In the same way, engineering education in India owes a big debt to a specialist in photo-chemistry, Jnanendrachandra Ghosh (or Jnanchandra Ghosh or Jnan Chandra Ghosh; 1893-1959).[5]

Nevertheless, the scientist in a colonial regime was often forced into the library in the absence of complementary laboratories. In his memoirs, Ray alluded to John Bunyan, who had to dig deep into his talents when external resources were denied, writing *The Pilgrim's Progress* during twelve years' imprisonment (1660-72) at the county gaol of Bedford. He also recalled Isaac Newton's withdrawal in 1665-6 from Cambridge because of the plague to Woolsthorpe Manor, where he formulated the principle of differential calculus and the law of gravitation. Ray drew a parallel between these instances and the circumstances of his pupil Jnanendrachandra Ghosh who, deprived of an adequate laboratory, discovered his theory of strong electrolytes almost entirely from his examination of books and journals. The same could be said of Meghnad Saha (1893-1956) who arrived at Saha ionization equation in 1920 through such readerly diligence.[6]

Ray's nationalism brought him into conflict with Rabindranath Tagore, especially on the subject of the spinning wheel as a weapon of *swadeshi*. However, Ray's nationalist project was not unlike that of the founders of Bangiya-Sahitya-Parishat, the literary academy established to bring together the cultural remains of Bengal in order to reconstruct the lineaments of a lost nation. It is not surprising that Ray should have served as President of the Bangiya-Sahitya-Parishat from 1931 to 1934, given his enthusiasm for teaching and writing on science in the Bengali language. But more important than his interest in promoting science in his native language was his love of literature, creative and critical. He once remonstrated with Tagore in jest for praising *Gaddalikā*, a book of stories written by Parasuram. Parasuram was the pseudonym of Rajsekhar Basu, the chemist he trained and who worked for Bengal Chemicals. Tagore had written a favourable review in *Prabāsi* in 1925, and Ray asked him not to give his protégé ideas and steal him away from chemistry. In reply, the poet threatened to reclaim all born writers who had strayed into the laboratory among whom, he suspected, Ray was one.[7]

It was a happy co-incidence that the National Library held two consecutive exhibitions in August 2010 to celebrate the 150th anniversary of Praphullachandra Ray and Rabindranath Tagore. The exhibition on Ray was held in association with Xpression Bengal, and was inaugurated on 2 August 2010 by the noted writer and economist Professor Sourin Bhattacharya. An exhibition entitled 'Death in the Literature of Tagore' followed, from 9 August to 16 August 2010. The exhibition was opened by the eminent writer of Bengali fiction, Sri Shirshendu Mukhopadhyay.

The exhibition on Ray continued until 7 August 2010, when the Advisory Board was scheduled to meet at the library. Sri Jawhar Sircar, Secretary to the Government of India, Ministry of Culture, visited the exhibition along with the Chairperson Sri A. R. Bandyopadhyay, the Joint Secretary, Dr T. Kumar and other members of the Board. Sri Sircar felt that a catalogue of holdings on and by Ray should be published, and the present effort owes to his suggestion and to the support of the Ministry.

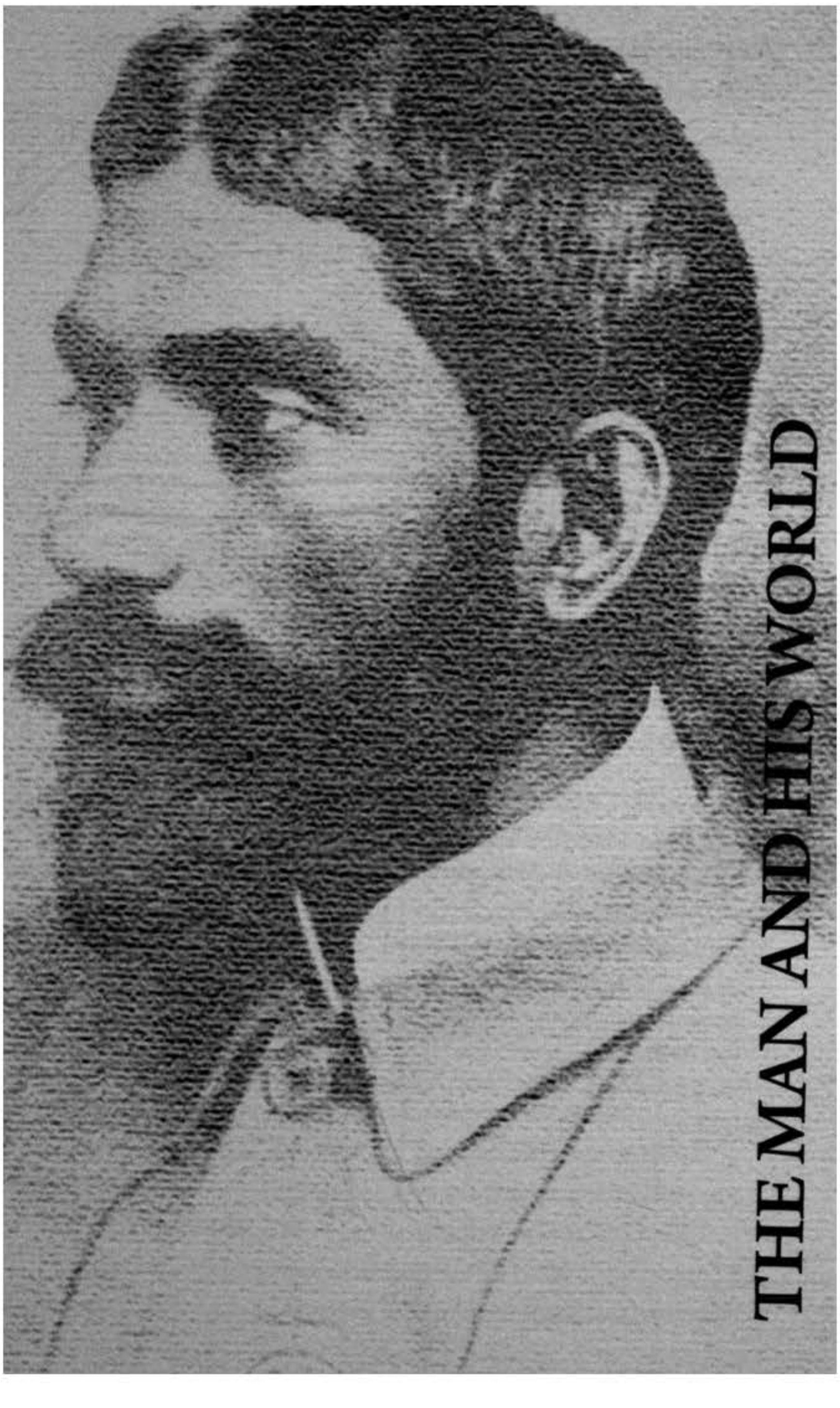
We would also like to thank Sri Arup Sadhu of Xpression Bengal for providing much of the visual material, Professor Sourin Bhattacharya for inaugurating the event, Dr Biman Nath for his essay on Ray, and Sri Pinaki De for designing the catalogue. The library staff collectively curated the exhibition, and put together the contents of the catalogue. Sri

Safalya Nandy was in overall charge of organization, and he was ably assisted by Srimati Shalini Vedaprakash of the Display Unit.

SWAPAN CHAKRAVORTY
February 2011

ENDNOTES

1. Praphulla Chandra Ray, *A History of Hindu Chemistry: From the Earliest Times to the Middle of the Sixteenth Century A. D., with Sanskrit Texts, Variants, Translation, and Illustrations*, vol. I (1902; 2nd revised and enlarged edition, Kolkata: The Bengal Chemical and Pharmaceutical Works Ltd., 1903), p. 190.
2. See Shyamal Chakravarti, *Oitihya uttaridhikār o vijnāni Praphullachandra* (Kolkata: Sahitya Samsad, 2009), p. 127.
3. P. C. Ray, *Life and Experiences of a Bengali Chemist*, vol.1 (Kolkata: Chuckervertty, Chatterjee and Co., 1932), p. 233.
4. Praphullachandra Ray, 'Gathanmulak rasāyaner unnati o dān', *Des*, 4.23 (24 April 1937); reprinted in *Des*, 75.10 (17 March 2008), pp. 36-7.
5. See Arupratan Bhattacharya, *Bāngālir vijnānbhāvānā o sādhanā* (Kolkata: Dey's, 2006), pp. 322-50.
6. Praphullachandra Ray, *Ātmacharit* (1931; 2nd edition, Kolkata: Orient Book, 1961), pp.151-2.
7. See Chakravarti, *Oitihya uttaridhikār o vijnāni Praphullachandra*, pp. 111-13.



THE MAN AND HIS WORLD

PRAPHULLACHANDRA RAY: THE ASCETIC AS SCIENTIST

The lens of time often distorts perception of historical figures. Viewed from a safe temporal distance, the life of Praphullachandra Ray may appear full of contradictions: a meticulous chemist, trained in the laboratories of the West, writing one of the best treatises on the history of ancient chemistry in India; a scientist leading an austere life yet setting up India's first pharmaceutical company. In an age when modern science was taking off in India, and eminent scientists were busy with their own projects, Ray single-handedly laid the foundation of a school of chemistry in this country. Unlike most other scientists of that era who sought to focus on science rather than risk their research by getting involved in the freedom movement, his was a solitary voice that said, 'Science can afford to wait but Swaraj cannot'[1]. Gandhi had once said of him: 'It is difficult to believe that the man in simple Indian dress and wearing simple manners could possibly be the great scientist and professor.'[2]

Such apparent contradictions make Ray a unique character in the tumultuous era preceding the independence of

India. These also allow us to put his life and work in perspective. Fierce nationalism, innovative and pragmatic entrepreneurship, uncompromising professionalism and excellence in scientific research, pride in one's scientific heritage that is not fuelled by sentiments but by years of dispassionate study of scientific history, and above all, a vision for the future of Indian science—this is the legacy of P. C. Ray. The uniqueness of the blend will be clear to anyone aware of the trends in modern Indian society, for these traits would cut an extraordinary figure even today.

Praphullachandra Ray was born in Raruli, a village that is now in Bangladesh, on 2 August 1861, the same year that saw the birth of Rabindranath Tagore. His ancestors were prosperous landowners, although the family wealth had declined by the time his father Harishchandra took charge of the estate. Harishchandra knew several languages and was a liberal in outlook— he would not mind secretly eating chicken, a taboo in Hindu families at the time, and teaching his children that beef was popular in ancient India. He had also set up in the neighbourhood the first school for girls, and even a rural co-operative bank.

Young Praphullachandra studied in the village school until the age of nine. His lessons were supplemented by his father's library that included books of literature and a number of encyclopaedias. When his elder brother finished school, Harishchandra decided to move to Kolkata in the interest of his sons' education. Praphullachandra was shocked at the urban filth, and was sneered at by his classmates for his accent. But he marvelled at the sights of the big city: 'A panorama of gorgeous vistas was opened to me', as he was to reminisce later. His school library (at Hare School, founded by David Hare) further fuelled his love for books.

> The prescribed text-books never satisfied my craving. I was a voracious devourer of books and, when I was barely 12 years old, I sometimes used to get up at three or four in the morning so that I might pore over the contents of a favourite author without disturbance. (*LEBC 1*, p. 29)

He read books on famous scientists, and in particular, he was fascinated by stories of Benjamin Franklin.

However, illness struck the child in 1874. He was bedridden for months with dysentery that ruined his digestive system, weakening him forever— he would have to maintain a strict diet throughout his life. The break from school gave him another opportunity to read more literature though, and he read Shakespeare as well as the new Bengali fiction of Bankimchandra Chattopadhyay.

After finishing school, he was admitted to the Metropolitan Institute, founded by Ishwarchandra Vidyasagar. It was here that he took to science, and in particular, chemistry:

> I took care...to attend lectures on chemistry in the First Arts Course, and both chemistry and physics in the Bachelor Arts Course in the Presidency College as an external student. Chemistry was then a compulsory branch in the F.A. Course. Mr. (afterwards Sir Alexander) Pedler was a first-rate hand in experiments; his manipulative skill was of a high order. I began almost unconsciously to be attracted to this branch of science. (*LEBC 1*, p. 47)

Praphullachandra even began experiments on his own at a friend's house and, eventually, chemistry became his primary passion.

Around this time, he won the Gilchrist scholarship to Edinburgh University, and sailed for Scotland in 1882. His delicate stomach made the debut voyage an unbearable experience, but on reaching England, he was received by Jagadish Chandra Bose, who was a student at Cambridge then, and the two struck up a lifelong friendship. At Edinburgh, noted chemists such as Alexander Crum Brown taught him. When the time came to choose a specialized course, he asked Professor Dittmar of Glasgow, a former assistant of Crum Brown, if he should follow in the footsteps of his classmates and take up physical chemistry. Dittmar advised him to be a 'chemical chemist first', an advice he remembered throughout his life—his research interests were not going to be confined to any narrow field of specialization. He finished his doctorate in inorganic chemistry in 1887. But he stayed on for one more year after winning the Hope Prize, and became Vice President of the University Chemical Society.

Edinburgh was certainly Praphullachandra's first encounter with the West, but it also provided the setting for the first outpouring of his nationalistic feelings. As an undergraduate, he participated in an essay competition announced by the Lord Rector of the University on the topic 'India before and after the Mutiny'. Praphullachandra set aside his chemistry books and delved into books on history in the University library. Soon he realized that he needed to learn the basics of economics in order to master the subject, and began to study political economy. This was years before Romesh Chunder Dutt (Rameshchandra Datta) wrote *The Economic History of India* (1902-4),3 and Praphullachandra had to go through all the primary sources. When he sat down to write after collecting the material and his thoughts, he was apprehensive whether he would be able to wield his pen as well as his test-tubes, but he surprised himself with his fluency.

The crux of his essay was his criticism of the British rule in India. He left no room for doubt on where the trouble lay:

> The lamentable condition of India at present is due to England's culpable neglect of, and gross apathy to, the affairs of that empire. England has hitherto failed— grievously failed in the discharge of her sacred duties to India. (*LEBC 1*, p. 63)

Later, he felt that simply criticizing colonial rule was not going to be useful. He wrote in his autobiography:

> I was a believer in those days in the doctrine of mendicancy and with child-like simplicity held that if the wrongs and the grievances under which our country groaned could be brought home to the British people, they would be remedied. The disillusionment was not long in coming. There is not in the history of the world a single instance of a dominant race granting concession to a subject people of its own free will and accord. (*LEBC 1*, p. 63)

A number of points he had raised in his essay are worth recalling, and may be of relevance even today. At one point he complained:

> We find there is a tendency among a certain class of writers to single out some of the worst types of Mohammedan

> despots and bigots, and institute a comparison between the India under them and the India of today.[4]

Praphullachandra's interest in history, and his thoughts on what constitutes an unbiased history, would surface later in life when he would take upon the task of writing a history of science in India.

His essay did not win the prize but was considered *proxime accesserunt* (closest to the best). Praphullachandra did not rest there. He distributed copies of his essay among the students and general public, and even sent a copy to John Bright, a member of parliament. Bright's reply to Praphullachandra was published in many newspapers. Bright wrote:

> There is an ignorance on the part of public in this country and great selfishness here and in India as to our true interests in India. The departures from morality and true statesmanship will bring about calamity and perhaps ruin, which our children may witness and deplore. (*LEBC 1*, p. 64)

Praphullachandra went back to studying his course after this incident. But it goes to show the uniqueness in his character—what he had done was not typical of a student studying science, and especially, of a student from India studying in England (although another Indian student, Pramatha Nath Bose, studying geology in London, had also participated in political meetings and criticized the colonial government[5]). His allegiance to science had not turned him blind to the society around him, and his thoughts about the society were nuanced by a careful study of the history.

Back in India in 1888, Praphullachandra joined Presidency College as a junior colleague of Professor Pedler. There was a hierarchy of jobs in the 'Imperial' and 'Provincial' categories, and Indians could only hope for a job in the 'provincial' rank, with rare exceptions. Praphullachandra came with excellent recommendations from his peers in England, but was denied a berth in the Imperial category.

Although disappointed, Praphullachandra took up the job in earnest, and set out to establish a modern laboratory. It would take him almost five years to become fully engaged in his laboratory research, and his major discoveries would have to wait until then. Nevertheless, his choice of topic for the first set of studies was again unique and shows his connection with the society in which he lived. He set out to analyse *ghee* (clarified butter) and mustard oil available in the market in order to determine the level of adulteration.

He had also become concerned about teaching science in the vernacular. Not only in science, but the use of a foreign language in all spheres of life in colonial India bothered him. In his autobiography, he gave an example of the farcical situation from the local court at that time:

> The last occasion when I sat on the jury box...there was a session's case of which I was chosen foreman. The judge was a Bengali and a former pupil of mine. The accused was a Bengali; the Advocate General, the Standing Counsel were all Bengali barristers, besides a Eurasian barrister, who of course knew Bengali. There was the face of the evidence in each case being translated by the Court interpreter before it could be 'heard' by the judge and the jurors.[6]

According to him, scientific education would have improved in our country if taught in the mother tongue, and he set out to write a few text books in Bengali.

Within five years of his return from England, *circa* 1893, Praphullachandra's work spread in four different directions. If he had pursued any one of these alone, it would have been enough to assure him a place in history. His contributions acquire a different dimension when we consider their timing in his life, and in particular, the fact that during this period he was suffering from acute insomnia, in addition to his chronic indigestion. In the words of Wilder Bancroft, an American chemist:

> this would be a marvelous thing for anybody to have done; but it is more remarkable when one considers that Ray has been what most of us would call an invalid all his life. When thirteen years old he had a bad attack of dysentery which became chronic, making him a permanent valetudinarian with impaired digestive organs. He was a victim of indigestion, diarrhea, and later on, of insomnia. He has had to submit to the most rigid observance of diet and regimen.[7]

Let us consider the four strands of his work in sequence. First, he started his research on a set of novel chemical compounds in the newly set up laboratory. Secondly, he had already begun to teach, spending considerable time on preparing his lectures, and this would be one of the dominant passions in his life, culminating in a school of chemistry, the first of its kind in India. Then he grew interested in setting up a chemical firm in order to produce chemicals for industrial use. Lastly, his old passion for history came back, and he undertook a mammoth project to write a definitive history of the chemical sciences in India.

His laboratory was finally ready in 1894, and in that year itself he discovered, almost serendipitously, a new substance called mercurous nitrite. It was a surprising discovery since stable complexes of mercury were hard to come by, and the nitrite ion was also not known to be stable. It therefore came as startling news to the scientific community, because it implied the existence of a stable substance that was composed to two relatively unstable ions. Praphullachandra published a paper on this discovery in the *Journal of Asiatic Society of Bengal,* and the news was reported in *Nature.*

Subsequent research in the following decades, however, has failed to reproduce this result.[8] A recent theoretical estimate of the enthalpy of mercurous nitrite also appears to show that the reaction is highly endothermic (requiring energy input), which might make it very unstable.[9] This does not, however, diminish in any manner the pioneering contributions of Praphullachandra—the discovery of mercurous nitrite was the first breakthrough in his career. But Praphullachandra did not rest there. He went on to do an exhaustive study of nitrites of various substances. Almost two decades later, Professor Henry E. Armstrong would visit his laboratory and commend him on his research:

> The way in which you have gradually made yourself 'master of nitrites' is very interesting and the fact that you have established, that, as a class, they are far from being the unstable bodies chemists had supposed, is an important

addition to our knowledge.[10]

Armstrong later commented in 1933 that 'as an example of thoroughness his work on the subject stands apart.'[11]

Praphullachandra's next big milestone was the synthesis of ammonium nitrite in pure form using a novel method (of double displacement between ammonium chloride and silver nitrite: $NH_4 Cl + AgNO_2 \rightarrow NH_4 NO_2 + AgCl$). Using reduced pressure, he could form crystalline needles of ammonium nitrite and showed the prevalent belief that it would undergo fast thermal decomposition (into N_2 and $H_2 O$) was not quite correct. He showed it to be more stable than previously thought. The result was highly appreciated in the community, and *Nature* wrote about the successful preparation of 'ammonium nitrite in tangible form' (*LEBC 1*, p. 174).

Later, he moved on to the topic of organic sulphur compounds. He synthesized many new compounds, like thiocamphor, and studied their interactions with the salts of mercury. The other major topic of his research was the co-ordination chemistry of metals like gold, platinum and iridium. He was a pioneer in this field. Since the methods of determining the structure was in infancy at the time, many of his original ideas of the structure of the compounds he synthesized have been revised, using modern methods. For example, the structure of the isomers that he isolated from the reaction of diethyl sulphide and iridium tetrachloride is now known to have a different structure than originally assigned by him. But the compounds he discovered are now known to have rich chemical properties. Especially, the metal cluster compounds, in which metal atoms are bonded to one another, are of great interest in chemical research today.

Praphullachandra was a born teacher. About lecturing, he once wrote, 'I was as much in my elements as a fish in water.' He was unique among the Indian scientists, or even his juniors, in that alongside his research, he spent a considerable amount of time to train a generation of scientists. After coming back to India, he spent a number of years practising the art of lecturing. He felt that a successful researcher might turn out to be a bad teacher if he did not work on making the lectures interesting, which for a chemistry teacher required to be backed with good skills in laboratory demonstrations. He knew that Professor Pedler had trained a couple of assistants for this purpose, and although any other person with a doctorate from England would have found it difficult to learn from an assistant, Praphullachandra had no such inhibitions.

> My ambition was to qualify myself as a successful lecturer and with this end in view, I put pride into my pocket. England-returned graduates are sometimes found to be a bit stuck-up. They think that they will lose caste or at any rate prestige if they have to learn anything from their subordinates. I am thankful that this sort of weakness was never able to get the better of me. (*LEBC 1*, p. 83)

Praphullachandra went on to become a legend in his time as a teacher. Students remembered his unique ways of teaching chemistry. Once he was teaching the properties of phosphate of calcium, produced from bone-ash, and was prescribed as a nerve tonic in the powdered form:

> I would often put a bit of the burnt bone into my mouth and chew it and even swallow it wholesale and invite my pupils

> to do the same. Some of them would readily come forward but others hesitated and could not shake off their orthodox notions. (*LEBC 1*, p. 99)

He took inspiration from the instances of famous chemists who were at the same time successful teachers of chemistry, and dreamed of generations of chemists in India that would follow. His dream began to materialize within two decades of his joining Presidency College. In 1909, a number of good students joined the college and opted to work with him: J. C. Ghosh and J. C. Mukherjee among them. Praphullachandra began to publish papers that were jointly written with students, and often let his students publish independently, which was not then in fashion, but which he thought would inspire them into becoming independent researchers.

A good teacher is quick to recognize raw talent, in addition to training students. Praphullachandra not only looked for accomplished chemists who would help him write research papers, he also spotted talents elsewhere. In 1910, he came in contact with a student who had failed his B Sc examination from St Xavier's college, and he noticed his ability in instrumentation. The student, Jitendrakumar Rakshit, could design from scrap marvellous instruments that one would have otherwise imported from abroad. He immediately employed Rakshit, who graduated to fundamental research in later years.

Within two decades of setting up his laboratory, Praphullachandra and his students had left an unmistakable mark on chemical research in India. *Nature*, in a report published in 1916, wrote about an emerging 'school of chemistry' in India, and about the influential papers coming out of this group of scientists: '...these papers are of very considerable value and interest, and indicate enthusiastic work on the part of this newly created school, which is mainly due to the example and work of Prof Ray...' (*LEBC 1*, p. 186). It may be of some interest that no one talked about a school of physics, although there were stalwarts in the subject at the time including Sir J. C. Bose. It was only after C. V. Raman's era that a school of physics took shape in India. In this respect once more Praphullachandra proved to be a visionary.

He retired from Presidency College and joined Calcutta University in 1916 as Palit Professor. There too he helped build a new laboratory, as he had done in Presidency College twenty years ago. He and his associates had to struggle for funds, as the colonial government was more interested in the recently founded Indian Institute of Science in Bengaluru. Indian scientists had no voice in running the Bengaluru Institute, whereas Calcutta University was a different matter altogether. (Years later, one of his students, J. C. Ghosh, was invited to become the Director of the Indian Institute of Science.)

Praphullachandra at this point was also worried about the publication of research papers from India. Although most of his papers during this period were published in the *Journal of the Chemical Society*, which was published from London, he seriously began to consider a research journal published from India. But one needed a professional forum for Indian chemists in order to bring out a journal of this kind. Praphullachandra's dream did not take long to be fulfilled. By the 1920s, Praphullachandra's students were grooming the next generation of chemists. S. S. Bhatnagar, the eminent chemist, was Praphullachandra's 'chemical grand pupil'. While doing research for his D Sc degree in the Univerisity of London, Bhatnagar discussed the issue of a 'chemical society' in India with J. C. Ghosh and J. N. Mukherjee in 1919. In 1924, they set up the Indian Chemical Society, the first of its kind in India for any branch of science, and Praphullachandra became its first President. The first issue of the *Journal of the Indian Chemical Society* was published in November 1924.

Praphullachandra's legacy in building the foundations of chemical research in India was aptly summed up by Rabindranath Tagore on the occasion of the former's seventieth birthday:

> It says in the Upanishads that the Supreme One wanted to be many. The urge for self-dispersal is at the root of this creation It was through this kind of creative urge that Prafulla Chandra became many in the minds of his pupils by diffusing and thereby reactivating himself in many younger minds.[12]

The epithet 'Acharya' that his students used for him pays tribute to his legacy as a teacher.

In 1893, around the time when he was busy acquiring instruments and materials for his laboratory, Praphullachandra became aware of the lack of a chemical industry in India. Important compounds such as sulphuric acid used to be produced in the most primitive manner, and stored in earthenware jars, a sight that irritated the chemist in him. He was also unhappy about most students of chemistry who seemed to be interested only in a degree and a job, instead of using their knowledge of chemistry either for a scientific career or business. He felt that,

> in Bengal the one thing needed was not so much the

> establishment of technological institutes as the initiative, the dash, the pluck, the resourcefulness in our youths that go to making of a business man, an entrepreneur, or a captain of industry. The college-bred youth has been found to be hopeless creature; there is no driving power in him; at best he can only shine as a tool or an automaton. These thoughts were weighing heavy on me at the threshold of my career at the Presidency College. (*LEBC 1*, p. 92)

He set up a small-scale factory with his savings, supplemented by a loan, and established the Bengal Chemical and Pharmaceutical Works in 1892. He began with few simple chemical compounds that he could manufacture on a profitable basis, like carbonate of soda and phosphate of soda. The initial years were anything but chaotic. One of the compounds he wanted to manufacture was super phosphate of lime, for which he needed bones to dry and then be pulverized. He had collected some bones of cattle. But that year it rained heavily and the collected bones began to stink, to the consternation of neighbours. Then he tried burning the semi-dried bones, which immediately attracted the policemen on guard in the vicinity.

Then he thought of making some medicines, such as Syrup Ferri Iodidi, Liquor Arsenicalis, Liquor Bismuth and so on. Old bottles were collected from the marketplace and used to sell the medicine. It was not easy to sell though, as the pharmacists complained that, 'Imported drugs from firms of established reputation command a ready sale, whereas indigenous drugs would be refused by our customers.' (*LEBC 1*, p. 101) His innovative ideas helped to some extent: he noticed that the syrup of iodide of iron became yellow after a few days whereas the samples imported from England remained green for a considerable period. He found that adding a bit of hypophophorus acid helped the syrup to retain its colour without compromising its medicinal properties. He also experimented with herbal products. For example, he discovered that an extract from leaves of the indigenous plant *basak* (*adhatoda vasica*) produced a better cough syrup than the then popular balsam of Tolu. He put up a stall exhibiting his herbal products in 1898 on the occasion of the Indian Medical Congress, and with a recommendation from the Medical Congress he set about selling his new products.

The firm Bengal Chemicals and Pharmaceuticals was started in 1901, with a small factory in Maniktala. Within a few decades, it had two thousand people as employees and had become 'the biggest sulfuric acid plant in India'.[13] Today it has four manufacturing units all over the country, including one in Mumbai and Kanpur. Although it had a monopoly of a few products in the market, like phenol, the profits of the company began to decline in 1960s, and in 1980 it was nationalized by the government.

To say that Praphullachandra's daily routine during the initial period in the 1890s was busy is an understatement. On holidays, he spent ten to twelve hours in his factory, and on other days he divided his time between his laboratory research and factory work. He reserved an hour for his bath and meal, and a couple of hours in the morning for his studies (he could not read after sundown because it would ruin all his chances of getting sleep in the night, on account of his insomnia). In his own words, 'when work is coupled with a keen sense of enjoyment, it doesn't tell upon your health.' (*LEBC 1*, p. 106) His studies in the morning mostly concentrated on preparing for his lectures and on modern chemistry. But soon he would find another topic for his study, and his contribution in this field would remain unparalleled, at least in Indian science.

Around this time (1893) he read a book of the history of chemistry written by a famous French chemist, Marcellin Berthelot, in which he read an account of the origin of alchemy. It was a relatively new book, published in 1885, and in it Berthelot traced the origin of alchemy to as far back as first century of the Common Era in Greece, and wrote about its evolution over a millennium. The book made Praphullachandra curious about the history of alchemy in India, and he collected some manuscripts and sent an essay on the topic to Berthelot. In reply, Berthelot sent him a copy of his works on medieval chemistry in Arabia, and it then occurred to Praphullachandra that someone should take up a similar project for the history of chemistry in India.

What he achieved was nothing less than monumental. His book *A History of Hindu Chemistry* was published in two volumes in 1902 and 1909. (One must remember here that in his time the word 'Hindu' meant Indian and did not pertain to any particular religion.) Praphullachandra was not looking for instances of achievements of ancient India in the manuscripts. On the contrary, he was guided by fundamental questions about the history of science in India. In the words of D P Chattopadhyay:

> ...when a working scientist of P C Ray's status wants to look back at scientific activities in ancient and medieval India, the understanding of science itself acquires a form far more serious than that of mere antiquarian curiosity...Thus, while most of the other scholars were on the whole contributing to the preparation of some kind of inventory of the achievements of the ancient Indians in different departments of science, P. C. Ray raised and tried to answer questions far more important for our understanding of the history

> of science...First, what infused real vitality into scientific activities in ancient India? Second, what inhibited their growth and caused its eventual decline?[14]

The first point made by Praphullachandra was to demolish the myth of Indian sages being mystical and loathe to experimental sciences. In a lecture given in 1918, he said:

> It is generally taken for granted that the Hindus were a dreamy, mystical people given to metaphysical speculation and spiritual contemplation...It should, however, be borne in mind that experimental sciences such as we now understand them are of very recent origin and growth, even in Europe... Experiments and observations constitute the fundamental bases of Science. It is naturally a relief to come across such dicta as laid down by two standard works on Hindu Chemistry, namely, *Rasendrachintamani* by Ramachandra and *Rasa-prakasha-sudhakara* by Yashodhara, both belonging to the thirteenth or fourteenth century AD. Says the former: 'That which I have heard of learned men and have read in the Shastras but have not been able to verify by experiment I have discarded. On the other hand those operations which I have, according to the directions of my sage teachers, been able to perform with my own hands— those alone I am committing to writing.'... Yashodhara, the author of the latter, observes: 'All the chemical operations described in my book have been performed with my own hands— I am not writing from mere hearsay. Everything related is based upon my own convictions.'[15]

Then Praphullachandra explained the discoveries made by the ancient scholars and their methods and apparatus used in the laboratories. Some of the revelations in the book are startling. For example, Praphullachandra found in a tantric text (*Rasarnava*), written *circa* 1000, that elements were identified using the colour of their flames: 'Copper yields a blue flame... that of the tin is pigeon-coloured; that of the lead is pale-tinted... that of the iron is tawny.' [16] This is the first recorded description of what is now known as flame test, learned by every chemistry student and which was re-discovered in Europe in 1859 by Robert Bunsen.

This was in stark contract to what Thomas Macaulay had to say in his infamous speech of 1835 in the parliament: '...there are no books on any subject which deserve to be compared to our own...medical doctrines, which would disgrace an English farrier—Astronomy ,which would move laughter in girls at an English boarding-school...'[17] This is the view that has been fed to the Indians ever since, and even today we do not have a clear, and dispassionate, idea about the achievements (or lack thereof) of ancient Indians in any other field of science. Praphullachandra's seminal work on the history of chemistry is an exception in this regard.

It stands alone not only in having translated ancient texts, but also for asking another fundamental question, and answering them in the best possible manner, about the decline of science in India. Firstly, he pointed out that the reasons for decline lay outside the framework of science itself, in the social conditions that were prevalent. He thought that the dominant cause for this was the caste system and the degradation of the social status of the craftsmen and other manual workers. According to him, the scientific spirit began to decline 'when the Brahmins reasserted their supremacy on the decline and expulsion of Buddhism'.[18] and when the caste system became rigid.

Praphullachandra's remarks on this issue were categorical:

> The draft of Manu and of the later Puranas is in the direction of glorifying the priestly class, which set up most arrogant and outrageous pretensions According to Sushruta, the dissection of dead bodies is a sine qua non to the student of surgery and this high authority lays particular stress on knowledge gained from experiment and observation. But Manu would have none of it. The very touch of a corpse... is enough to bring contamination to the sacred person of a Brahmin. Thus we find that shortly after the time of Vagbhata, the handling of a lancet was discouraged and anatomy and surgery fell into disuse and became to all intents and purposes lost sciences to Hindus.[19]

Praphullachandra was the first to locate the reason for the decline in science in this manner. His book was published much before the era when the historiography of science came to be studied in earnest. This was well before J. D. Bernal wrote about the connections between society and scientific research in his monumental work *Science in History* (1954). Praphullachandra's study also preceded, for example, the book *Head and Hand in Ancient Greece* by Benjamin Farrington by almost half a century, in which the decline of Greek science was located in the degradation of manual work there. Incidentally, Praphullachandra was not oblivious of the dangerous effect of the social degradation of manual workers elsewhere in the world: 'Similar dangers have threatened Europe from time to time but her sturdy sons have proved better of them in the long run.'[20]

At the same time Praphullachandra did not overlook the effect of philosophical texts on the scientific spirit. He clearly saw that there were some philosophical views which that favoured science whereas there were others which were dangerous. For example, he thought the philosophy of atomism had a scientific potential, but the world-denying metaphysics and the concepts of *maya* in Samkara's Vedanta was hostile to the scientific spirit. It would take some nerve even today for scholars to state this categorically, but Praphullachandra was not a person to dither. He wrote: 'The vedanta philosophy, as modified and expanded by Samkara, which teaches the unreality of the material world, is also to a large extent responsible for bringing the study of physical science into disrepute.'[21]

Given Praphullachandra's awareness of the society around him, his sense of history and his vision, it would have been surprising if he had holed up himself in the ivory towers of his laboratory like his contemporaries. His Bengal Chemicals was already a manifestation of his ideas of economic liberation. He found a kindred heart in M. K. Gandhi in 1901. Praphullachandra was in close contact with G. K. Gokhale, who had introduced him to Gandhi during a visit to Kolkata. He later reminisced about the meeting: 'I was attracted to him from the very first by his magnetic personality and our common devotion to ascetism.'[22] It was Praphullachandra who organized a meeting at the Albert Hall on 20 January 1902 for Gandhi to speak in Kolkata for the first time.

It might come as a surpirse to many now, but Praphullachandra became an ardent supporter of Gandhi's philosophy of *charkha* (the spinning wheel) and *khadi*, which he thought was important in order 'to supplement the scanty income of the dwellers in the villages by the introduction and encouragement of a subsidiary occupation.'[23]

This had once brought him to criticize Tagore who was not enthusiastic about *charkha* becoming a tool for economic liberation or *swaraj*. Praphullachandra wrote in his autobiography:

> My speeaches and writings on Khaddar during the last seven and eight years, if put together, would fill a big volume. Yet it is necessary to harp on the subject because of the callous indifference of a section of our intelligentsia who would do nothing, create nothing, but simply live as parasites, and indulge in cheap sneers and gibes from their snug and comfortable easy chairs in the towns.[24]

Tagore responded in his essay 'The Cult of the Charkha': 'Acharya Praphullachandra Ray has marked me with his censure in printer's ink, for that I have been unable to display enthusiasm in the turning of the charkha.'[25] Tagore argued that one would do better to keep pace with modern science instead of being isolated from the rest of the world.

Praphullachandra's views on modern science and its practice in India differed from that of Tagore— he was a practitioner of modern science and even his critics would not say that his views were of a sentimental nature. His views about the effect of Western civilization in India, which had been forming since his student days, had grown stronger over the years. During a devastating flood in north Bengal in 1922, in which he organized a massive relief work with his students, he located the root cause of the flood in the building of railway embankments:

> The root cause is the same, namely obstruction to natural passages of water on account of embankments for setting up cheap lines of communications. Canals are sketched out on a map in straight lines. No consideration is given to the drainage of the surrounding lands. (*LEBC 2*, p. 156)

The relief work organized by him was noted by a correspondent of the *Manchester Guardian*, who wrote:

> He is a real organiser and a real teacher. I heard a European saying, 'If Mr. Gandhi had been able to create two more Sir P C Rays, he would have succeeded in getting Swaraj within this year.' (*LEBC 1*, p. 243)

Not only floods, but Praphullachandra had scathing remarks for the ill effects on the health of the population: '[famines and pestilences] which levy such a huge toll every year in ill-fated Bengal were scarcely known six decades ago; somehow or other they have synchronized with British rule'(*LEBC 1*, p. 243). Unlike Tagore, who believed in the innate humanism of the Europeans and appealed to 'let India stand for the cooperation of all peoples of the world', [26] Praphullachandra's views veered toward that of Gandhi. 'His views are summarized in the statement— Western civilization is our ruin; we are on the way dimly to foresee that it may be ours,' wrote Henry Armstrong, in an article on Praphullachandra in 1933. And he acceded in the same article that, 'often severely critical, Sir P. C. Ray is undoubtedly anti-English in his present sympathies—but he is mainly so on account of his greater sympathy with his fellow Indians— and his criticisms are constructive.'[27]

At the same time, Praphullachandra was also unhappy about his fellow Bengalis: 'The Bengali is cheerless, does not know how to enjoy life. He is dreamy and loves to lead a somnolent sort of existence.' (*LEBC 1*, p. 138) His sense of depression at the utter lack of perseverance in the average Bengali was heightened both by his reading of history of science in India and his experiences in Europe. He had even written an essay on the 'Bengali Brain and its Misuse' (*Banglar mastishka o tahar apabybahar*) in 1909, in which his contempt for the medieval logicians of Bengal was clear. 'I think those who, depending on the opinion of Bhudeb and Bankim, take pride in the glorious achievement of the Bengali or even of the Hindu intellect are ignorantly supporting erroneous views.'[28] He had certainly earned the right to say this as no one knew better than him what Indian scholars had done in the past, but he never let passion get in the way of social appraisal.

But he was far from being pessimistic. His criticisms were only meant to galvanize a sleeping society.

> India must wake up, shake off her degradation, put life and heart into every class of her people, elevate her women and depressed classes and remove the galling restrictions of caste and all social inequalities. When this is done she will enter into a new era of her life and then, like Prometheus unbound, she will be recognized as a great power in the world and will have an unique place in the comity of nations.[29]

Praphullachandra led the life of an ascetic in the later years. On his sixtieth year in 1921, he donated his entire salary from that point onward to the university with the condition that the money should be spent on the development of the chemistry department. From this money, a few rooms were added to the chemistry department, and one room was given to Praphullachandra for him to stay. (F. G. Donnan of the University College of Science, London, once described him as the 'St Francis of Indian science' for his 'Spartan simplicity and frugality'.[30]) The room was divided into three small compartments by partition to serve as the kitchen, a storeroom and a bedroom. He was not a recluse, but scarcely found time to meet others for pleasure ('Circumstances have, however, even forced me to be a stranger, as it were, to my nearest blood relations.' [*LEBC 1*, p. 226]). He kept the hours of the day for his laboratory and other work, and the evenings, for the Maidan Club, when he would meet his students and take a walk, followed by a rest for an hour or two, under the statue of Lord Robert in the open grounds adjoining Fort William known as the *maidan* in Kolkata, and discuss all topics under the sun. These meetings were never an occasion for him to air his views and pontificate— but 'all members, old and young, were equally free and at liberty to participate and give their opinion without any reservation.'[31]

Praphullachandra died in 1942 in his University room, surrounded by his students and friends. Successful scientists, and perhaps all creative people, often turn out to be difficult people. Competitiveness and the research-induced isolation from society often impart unpleasant streaks in their characters. In modern India, there has been a tradition of senior scientists building their own institutes in which they would spend their final years. Beginning with Sir J. C. Bose, who built an institute of his own (and who faced opposition to such a move from none other than Ashutosh Mukherjee [32]) after he was dissatisfied with the conditions under which he worked, this tradition has plagued scientific research in modern India. Praphullachandra remains exceptional in this respect too. It is difficult to name another scientist of his stature—with the same predilection for plain speaking as he had—who remained a popular and revered figure among his students and colleagues until his last day. It was not for mere sentimental reasons that his students called him *Acharya*, or that European scientists called him 'an Indian sage'.[33]

A hundred years after the peak period in Praphullachandra's career, it is natural to wonder about the relevance of his ideas and works. But this demand, of asking historical figures if their ideas still matter today, perhaps smacks of arrogance, and has an implicit belief that society always progresses with time. One could rather do a different thought experiment. Instead of demanding to know which aspect of Praphullachandra's life and work might still be important to us, we could try to imagine how he would have felt if he were to be magically transported to the present era. It cannot but dishearten us to discover that as a society we have probably failed in all aspects of his vision for life and research.

In science, we have lost the pioneering spirit of the founders of modern science in India. Teaching and training a new generation of students in research also took a back seat in India soon after independence when research institutes were established and kept isolated from universities where students were taught. It has been often said that this divorce of research from teaching of science has led to the sorry state of affairs in Indian science. Elsewhere in the world, scientific research takes place alongside the teaching of science—an ideal that Praphullachandra had exemplified throughout his life. But in modern India, the thrust has been on making élite institutes and ensuring their isolation from the rest of society. This situation now has, however, forced some research institutes to reconsider the merit of mixing teaching with research. A few new institutes have been recently set up in the country that would involve both teaching and research.

In other spheres, our industry is now more concerned about easy profit than investing in research and development—a far cry from the ideals behind Bengal Chemicals. There are exceptions to this trend though, and one hopes for an improvement in the connection between academic institutions and industry in the future. As a society in general, we have become fond of either ignorantly imitating the West, or taking false pride in the achievements of ancient Indians in a sentimental and uninformed manner. Both attitudes would have disappointed Praphullachandra.

He was a unique figure in his days, and he would have been more so if he were alive today. His legacy is more relevant today than perhaps in the past. It is possibly not too late to look back and recall the science and sage in him, whose life indeed was his message.

BIMAN NATH
February 2011

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ENDNOTES

1. P. C. Ray, *Life and Experiences of a Bengali Chemist*, vol. 1 (Kolkata: Chukervertty, Chatterjee & Co., 1932), p. 228. The abbreviation *LEBC 1* and page numbers in brackets follow quotations from the work in the text.

2. As quoted in *Acharya Praphullachandra Ray: Birth Centenary Souvenir Volume* (Kolkata: University of Calcutta, 1962), p. 23.

3. R. C. Dutt, *The Economic History of India under Early British Rule. From the Rise of the British Power in 1757 to the Accession of Queen Victoria in 1837*, vol. 1 (London: Kegan Paul, Trench Trübner, 1902); and idem, *The Economic History of India in the Victorian Age: From the Accession of Queen Victoria to the Commencement of the Twentieth Century*, vol. 2 (London: Kegan Paul, Trench Trübner, 1904).

4. As quoted by W. D. Bancroft, Review of *Life and Experiences of a Bengali Chemist*, *Journal of Chemical Education*, 11.4 (1934), p. 256.

5. Deepak Kumar, 'The Quest for Identity in Science and the Seeds of Decolonisation: India 1860-1920', in *Sciences coloniales: figures et interventions*, ed. P. Petitjean and R. Waast (Paris: IRD Editions, 1996), p. 304.

6. P. C. Ray, *Life and Experiences of a Bengali Chemist*, vol. 2 (Kolkata: Chukervertty, Chatterjee & Co., 1935), p. 63. The abbreviation *LEBC* 2 and page numbers in brackets follow quotations from the work in the text.

7. Bancroft, Review of *Life and Experiences of a Bengali Chemist*, pp. 255-6.

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9. D. Banerjea, 'Chemistry in India: A Short Historical Perspective and Foundation of the Indian Chemical Society', *Journal of Indian Chemical Society*, 81.12 (2004), p. 1018.

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12. As quoted in *Acharya Praphullachandra Ray: Birth Centenary Souvenir Volume*, pp. 28-9.

13. Bancroft, Review of *Life and Experiences of a Bengali Chemist*, p. 255.

14. D. P. Chattopadhyay, 'P. C. Ray', in *The Scientist in Society* (Kolkata: Thema, 2000), pp. 11-12.

15. Ibid., pp. 12-13.

16. P. C. Ray, *A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century AD* (Kolkata: Bengal Chemical & Pharmaceutical Works Limited, 1902), p. 68.

17. *Speeches of Lord Macaulay with his Minute on Indian Education*, ed. G. M. Young (Oxford: Oxford University Press, 1979); as excerpted in Bill Ashcroft et al (eds), *The Post-Colonial Studies Reader* (1995; 2nd edition, New York: Routledge, 2006), p. 374.

18. Ray, *History of Hindu Chemistry*, p. 192

19. Chattopadhyay, 'P. C. Ray', pp. 12-13.

20. Ray, *History of Hindu Chemistry*, p. 194.

21. Ibid., p. 195.

22. Ibid., p. 126
23. Ibid., p. 375
24. Ibid., p. 375
25. Rabindranath Tagore, 'The Call of Truth', in *The Mahatma and the Poet: Letters and Debates between Gandhi and Tagore 1915-1941,* ed. Sabyasachi Bhattacharya (Delhi: National Book Trust, 1997), pp. 68-87, 99.
26. Tagore, 'Call of Truth', p. 61.
27. Armstrong, 'Indian Sage', p. 674.
28. As quoted in R. K. Dasgupta, 'Acharya Ray as a Man of Letters', in *Acharya Praphullachandra Ray: Birth Centenary Souvenir Volume,* p. 14.
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31. Ibid., p. 27.
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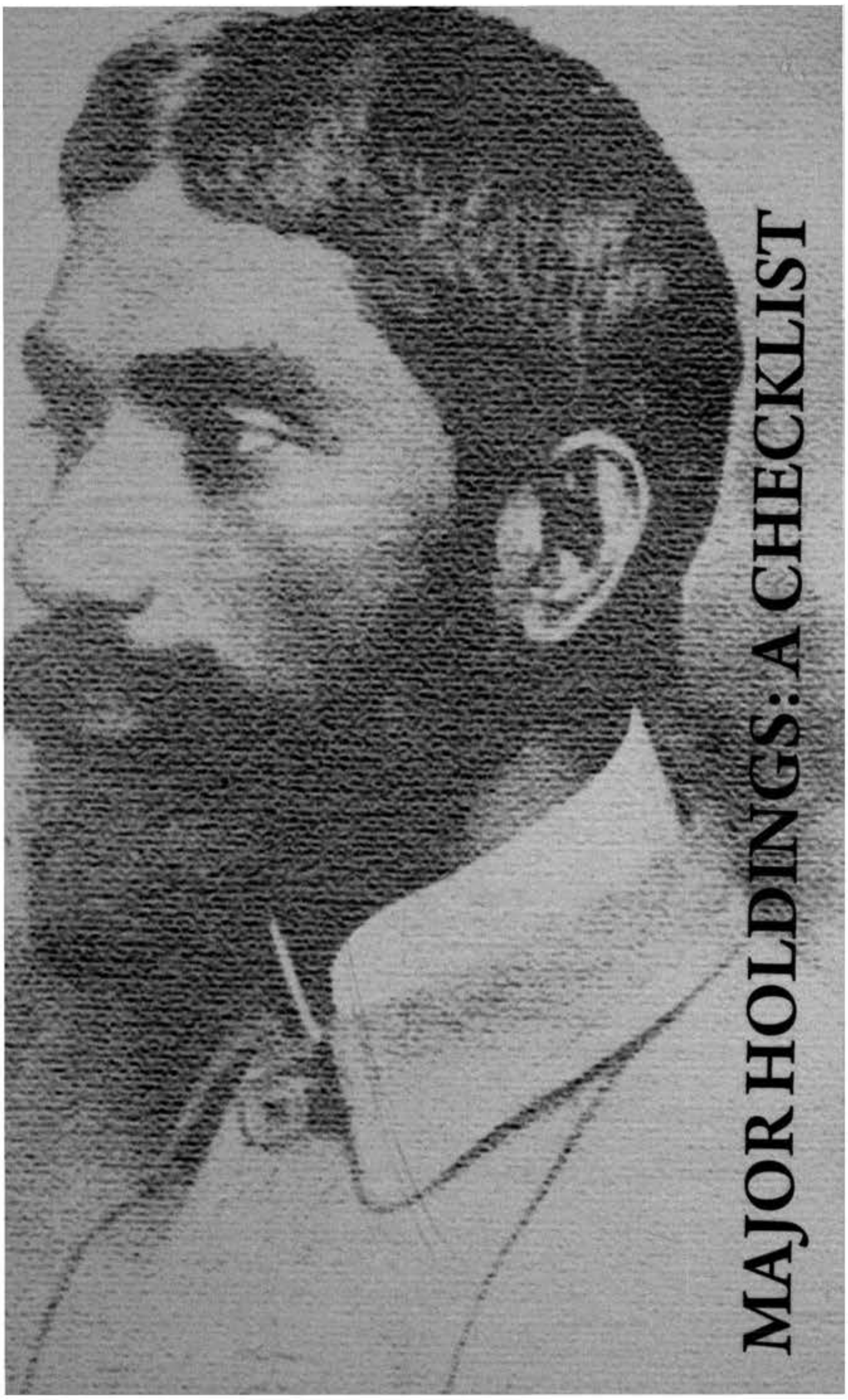
33. Armstrong, 'Indian Sage', pp. 672-4



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04

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Author/Editor	Ray, Praphullachandra
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05

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Author/Editor	Ray, Praphullachandra
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Author/Editor	Ray, Praphullachandra
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08

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Title	*A history of Hindu chemistry: from the earliest times to the middle of the sixteenth century A. D., with Sanskrit texts, variants, translation*

	and illustrations
Imprint	Calcutta: The Bengal Chemical and Pharmaceutical Works Ltd, 1909
Physical Description	v. p.; ill., plates; 18 cm
Subject	Chemistry—History—India

09

Call No.	E 540.954 R 212 c
Author/Editor	Ray, Praphullachandra
Title	*A history of Hindu chemistry* (with a word by Syamal Chakrabarti)
Edition	Centenary
Imprint	Kolkata: Saibya Prakashan, 2002
Physical Description	2 v. in one; v. p.; 18 cm
Subject	Chemistry—History—India
ISBN	8187051833
Note	With Sanskrit texts, variants, translation and illustrations

10

Call No.	153.G 107
Author/Editor	Ray, Praphullachandra
Title	*Elementary inorganic chemistry adapted to meet the requirements of tr. I. Sc. standards of the Universities of Calcutta and Allahabad*
Imprint	Calcutta: N. N. Palit, 1909
Physical Description	[xii], 217 p.; ill.; fold; plates; ports; 18 cm
Subject	Chemistry
Subject	Inorganic Chemistry

11

Call No.	153.G 107 (1)
Author/Editor	Ray, Praphullachandra
Title	*Elementary inorganic chemistry adapted to meet the requirements of tr. I. Sc. standards of the Universities of Calcutta and Allahabad*
Edition	2nd ed.
Imprint	Calcutta: The Bengal Chemical and Pharmaceutical Works, 1910
Subject	Chemistry
Subject	Inorganic Chemistry

12

Call No.	163.G 107 (1)
Author/Editor	Ray, Praphullachandra
Title	*Elementary inorganic chemistry adapted to meet the requirements of tr. I. Sc. standards of the Universities of Calcutta and Allahabad*
Imprint	[s.i.], [s.n.], 1912
Subject	Chemistry
Subject	Inorganic Chemistry

13

Call No.	172.H.223
Author/Editor	Ray, Praphullachandra
Title	*Bengali brain and its misuse*
Imprint	Calcutta: The City Book Society, 1910
Physical Description	[ii], 50 p.; port.; 18 cm

Subject	Education—Bengal
Subject	History—Bengal

14

Call No.	175 F 247
Author/Editor	Ray, Praphullachandra
Title	*Essays and discourses: with a biographical sketch and a portrait*
Imprint	Madras: G. A. Natesan, 1918
Edition	1st ed.
Physical Description	[iv], [xxxii], 349 p.; front.; 18 cm
Subject	India—History
Subject	Authors—Criticism and Interpretations

15

Call No.	E 954 R 212e
Author/Editor	Ray, Praphullachandra
Title	*Essays and discourses: with a biographical sketch and a portrait*
Imprint	Madras: G. A. Natesan, 1918
Physical Description	[xl], 349 p.; 23 cm
Subject	India—History
Subject	Authors—Criticism and Interpretations

16

Call No.	153 G 225
Author/Editor	Ray, Praphullachandra
Title	Organic thio-compounds with special reference to tautomeric changes and the formation of

	polysulphonium derivatives
Imprint	Calcutta: University of Calcutta, 1919
Physical Description	[viii], 70 p; 24 cm
Subject	Chemistry
Subject	Organic Chemistry

17

Call No.	135 F 381
Editor	Ray, Praphullachandra, ed.
Title	Desi rang
Imprint	Calcutta: The Book Company [1922]
Physical Description	[iv], 72 p., 18 cm
Subject	Chemistry
Subject	Manufacturing Industries—India

18

Call No.	182 DC 922.1
Editor	Ray, Praphullachandra, ed.
Title	*Desi rang : recipes with the process of preparation of indigenous dyes and the specimens of dyed cloth*
Imprint	Calcutta: Chuckervertty, Chatterjee & Co., 1922
Physical Description	v. p.; 18 cm
Subject	Chemistry
Subject	Manufacturing Industries—India

19

Call No.	182 DC 922.6
Editor	Ray, Praphullachandra, ed.

Title	*Desi rang: recipes with the process of preparation of indigenous dyes and the specimens of dyed cloth*
Imprint	Calcutta: Chuckervertty, Chatterji & Co., 1922
Physical Description	v. p.; 18 cm
Subject	Chemistry
Subject	Manufacturing Industries—India

20

Call No.	E/O 338.63 R 212
Author/Editor	Ray, Praphullachandra
Title	*Message of khaddar: address on the opening ceremony of Khadi Exhibition*
Imprint	1923
Physical Description	9 p.; 30 cm.
Subject	History—India
Subject	Weaving

21

Call No.	153.G. 255
Author/Editor	Ray, Praphullachandra; with a foreword by P. J. Hartog
Title	*Makers of modern chemistry: Dacca University Extension Lectures*
Imprint	London: Probsthian, 1925
Physical Description	[viii], 110 p.; plates; port.; 22 cm
Subject	Chemistry—Biographies

22

Call No.	172.F 675
Author/Editor	Chaudhuri, Kshitis Chandra

Title	*The history and economics of the land system in Bengal*: with a foreword by Sir P. C. Ray
Imprint	Calcutta: The Book Company, 1927
Physical Description	[xxii], 148 p.; 21 cm
Subject	Land Reform—Bengal
Subject	Economics—Economic History

23

Call No.	169.D 735
Author/Editor	Ray, Praphullachandra, Sir
Title	*Radha Charan Pal : a study*
Imprint	Calcutta: University College of Science, 1931
Physical Description	16 p; 22 cm
Subject	India—Biography

24

Call No.	E/O 338.0954 R 212
Author/Editor	Ray, Praphullachandra
Title	*The industrial development of India*
Imprint	Nagpur: The University, 1932
Physical Description	26 p.
Subject	India—Industry

25

Call No.	IC 540.954 R 213
Author/Editor	Ray, Praphullachandra, Sir
Title	*History of chemistry in ancient and medieval India: incorporating the history of Hindu chemistry*, edited by T. Ray

Imprint	Calcutta: Indian Chemical Society, 1956
Physical Description	[ii], 494 p.; ill.; port.; maps; 25 cm
Subject	Chemistry—History—India
Subject	Science—Medieval
Added Author	Ray, Priyadaranjan, edt.

26

Call No.	E 504 /Ac 44
Editor	Ray, Praphullachandra, ed.
Title	*Acharya (Sir, Dr) P.C. Ray's three convocation addresses: National Muslim University of Aligarh, Unversity of Mysore and Benaras Hindu University*
Imprint	Calcutta: R.K.B.K. Acharya Praphullachandra Sammilani, 1989
Physical Description	[iv], 108 p.; 21 cm
Subject	Education—India

27

Call No.	E 92 R 212 r
Editor	Ray, Praphullachandra
Title	*Life and experiences of a Bengali chemist*
Imprint	Calcutta: Chuckervertty, Chatterjee, 1932
Physical Description	2 v.; 557 p.; plates; facsim.; 23 cm
Subject	Chemists—India—Biography
Subject	India—Intellectual Life
Subject	Ray, Praphullachandra, 1861-1944

28

Call No.	SC 92 R 212
Editor	Ray, Praphullachandra, Sir
Title	*Life and experiences of a Bengali chemist*
Imprint	London: Kegan Paul, 1932
Physical Description	2 v.; [viii], 557 p.' plates; fold; facsim.; 23 cm
Subject	Chemists—India—Biography
Subject	India—Intellectual Life
Subject	Ray, Praphullachandra, 1861-1944

29

Call No.	152 B 1
Editor	Ray, Praphullachandra, Sir
Title	*Life and experiences of a Bengali chemist*
Imprint	Calcutta: Chuckervertty, Chatterjee, 1932-5
Physical Description	2 v.; plates; 22 cm
Subject	Chemists—India—Biography
Subject	India—Intellectual Life
Subject	Ray, Praphullachandra, 1861-1944

30

Call No.	E 92 R 212
Editor	Ray, Praphullachandra
Title	*Autobiography of a Bengali chemist* (with a foreword by Jawaharlal Nehru)
Imprint	Calcutta: Orient Book, 1958
Physical Description	[xv], 464 p.; 16 p. of plates; 22 cm
Subject	Ray, Praphullachandra, 1861-

	1944—Biography
Subject	Chemistry—History—India

31

Call No.	Sans 808 Ra 243
Author/Editor	Ray, Praphullachandra and Kaviratna, Haris Chandra
Title	*Rasarnava*
Imprint	Calcutta: Asiatic Society, 1985
Series	Bibliotheca Indica, no. 175
Physical Description	12, 84 p.; 22 cm
Subject	Ancient India—Chemistry

32

Call No.	E/O 508.2 D 262
Editor	Datta, Hirendranath [et al]
Title	*Acharyya Ray commemoration volume*
Imprint	Calcutta: N.C. Pal, 1932
Physical Description	[xxiv], 615 p.; front.; plates; 26 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

33

Call No.	E 92 R 212 g
Author/Editor	Gupta, Manoranjan
Title	*Prafullachandra Ray: a biography*
Imprint	Bombay: Bharatiya Vidya Bhavan, 1966
Physical Description	[xvi], 158 p.; 19 cm
Series	Bhavan's Book University, v. 134
Subject	Ray, Praphullachandra, 1861-

34

Call No.	E 92 R 212 c
Title	*Acharya Prafulla Chandra Ray: birth centenary souvenir volume*
Imprint	Calcutta: University of Calcutta, 1962
Physical Description	[x], 310 p.; ill.; facsims.; ports.; 26 cm
Subject	Ray, Praphullachandra, 1861-1944

35

Call No.	E 508.2 Ac 44
Author/Editor	Santimay Chatterjee and Amitabha Sen, edt.
Title	*Acharya Prafulla Chandra Ray: some aspects of his life and works*
Imprint	Calcutta: Indian Science News Association, 1986
Physical Description	[x], 173 p.; port.; 23 cm
Subject	Scientists—India—Biography
Added Author	Chatterjee, Santimay, edt.
Added Author	Sen, Amitabha, edt.
Added Corporate Author	Indian Science News Association

36

Call No.	E 509.5414 L 934
Author	Lourdusamy, J.
Title	*Science and national consciousness in Bengal (1870-1930)*
Imprint	New Delhi: Orient Longman, 2004
Physical Description	[xii], 257 p.; 22 cm

Subject	Scientists—India—Biography
Series	New perspectives of South Asian history; v. 8
Subject	Science—Bengal—History—19th Century
Subject	Science—Social Aspects—Bengal
Subject	Science—Bengal—History—20th Century
ISBN	8125026746

37

Call No.	E 540.954 P176
Author	Palit, Chittabrata and Das, Chirantani
Title	*Acharya Prafulla Chandra Ray and Indian chemistry*
Imprint	Kolkata: Readers Service, 2007
Physical Description	128 p.; 21 cm
Subject	Chemistry—India—History
Subject	Praphullachandra Ray, 1861-1944
Added Author	Das, Chirantani
ISBN	8187891688

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Multiple copies with the same call number have not been entered separately.

01

Call No.	182 Kd. 906.3
Author/Editor	Ray, Praphullachandra
Title	*Navya rasayani vidya o tahara utpatti*
Imprint	Kolkata: Bangiya-Sahitya Parishat, 1906
Physical Description	[xii], 79 p.; 18 cm
Subject	Chemistry

02

Call No.	182 Pd. 909.3 (1)
Author/Editor	Ray, Praphullachandra
Title	*Vangalira mastiska o tahara apavyavyara*
Imprint	Kolkata: City Book Society, 1909
Physical Description	39 p.; 17 cm
Subject	Bengal—History
Subject	Education

03

Call No.	182 Pc 918.8
Author/Editor	Ray, Praphullachandra
Title	*Vangalira mastiska o tahara apavyavyara*
Edition	2nd ed.
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1918

Physical Description	[ii], 38 p.; 17 cm
Subject	Bengal—History
Subject	Education

04

Call No.	182 Pc 919.11
Author/Editor	Ray, Praphullachandra
Title	*Samaja samskara samasya: Presidential address at the Indian National Conference held at Calcutta in 1918 on the problem of social reform in Bengal*; translated into Bengali by Satischandra Cattopadhyaya
Imprint	Kolkata: Bengal Chemical Press, 1919
Physical Description	21 p.; 18 cm
Subject	Bengal—Social Sciences
Subject	Education
Added Author	Cattopadhyaya, Satisacandra, trl.
Note	Pages 1-13 missing

05

Call No.	182 Pc 920.7
Author/Editor	Ray, Praphullachandra
Title	*Jatibheda o patitya samasya: a pamphlet on the evils of the caste system and the treatment of the depressed classes in India*
Imprint	Kolkata: Bengal Chemical Steam Press, 1920
Physical Description	[ii], 32 p.; 19 cm
Subject	Bengal—Social Sciences
Subject	Education

06

Call No.	182 Pc 920.19
Author/Editor	Ray, Praphullachandra
Title	*Adhyayana o sadhana: synopsis of a lecture urging the scholars of this country on the necessity of the practical application of learning acquired in the University*
Imprint	Kolkata: Modern Publishing House, 1920
Physical Description	[ii], 61 p.; 19 cm
Subject	Social Sciences
Subject	Education

07

Call No.	182 Pc 933.10
Author/Editor	Ray, Praphullachandra
Title	*Adhyayana o sadhana: synopsis of a lecture urging the scholars of this country on the necessity of the practical application of learning acquired in the University*
Edition	Another edition
Imprint	Kolkata: Barada Agency, 1933
Physical Description	[ii], 61 p.; 18 cm
Subject	Social Sciences
Subject	Education

08

Call No.	182 Pc 921.1
Author/Editor	Ray, Praphullachandra
Title	*Jatigathane badha—bhitare o*

	bahire: a pamphlet deploring the degraded condition of India, due to the obstacles, internal and external, to the building of a nation, suggesting means for improvement
Imprint	Kolkata: Brahmamission Press, 1921
Physical Description	[ii], 16 p.; 18.5 cm
Subject	India—Social Sciences

09

Call No.	182 Dc 922.2
Author/Editor	Ray, Praphullachandra
Title	*Vastra samasya: a pamphlet on the problem of clothes*
Imprint	Kolkata: Bengal Chemical Steam Press, 1922
Physical Description	6 p.; 19.5 cm
Subject	India—Manufactures
Subject	India—Industries

10

Call No.	182 Pc 936.2
Author/Editor	Ray, Praphullachandra
Title	*Annasamasyaya vangalira parajaya o tahara pratikara: discourses on the economic problems of the Bengalis, pointing out the defects in the Bengali character and their remedy*
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1936
Physical Description	[xxviii], 240 p.; 18 cm
Subject	Bengal—Social Sciences—Economic conditions

11

Call No.	B 330.95414 Ra 597
Author/Editor	Ray, Praphullachandra
Title	*Annasamasyaya vangalira parajaya o tahara pratikara*
Imprint	Calcutta: Orient Book Company, 1967
Edition	3rd ed.
Physical Description	Kolkata: Park Book Bureau, [n.d.]
Subject	[xxxii], 236 p.; 18 cm
Subject	Bengal—Social Sciences—Economic conditions

12

Call No.	B 330.95414 Ra 597 a
Author/Editor	Ray, Praphullachandra
Title	*Annasamasyaya vangalira parajaya o tahara pratikara*
Imprint	Kolkata: Park Book Bureau, 1967
Physical Description	[6, xxxvi], 237 p.; 19 cm
Subject	Bengal—Social Sciences—Economic Conditions

13

Call No.	B 891.444 Ra 597 a
Author/Editor	Ray, Praphullachandra
Title	*Annasamasyaya vangalira parajaya o tahara pratikara*
Imprint	Kolkata: Bhabanipur Book Bureau, [n.d.]
Physical Description	237 p.; 18 cm
Subject	Bengal—Social Sciences—Economic Conditions

14

Call No.	182 Pb 925.2
Author/Editor	Ray, Praphullachandra
Title	*Khulna Jela Sammilanira Abhyarthana Samitira sabhapatira abhibhasana: the address delivered by the author as chairman of the Reception Committee at the Khulna District Conference*
Imprint	Kolkata: Bengal Chemical Press, 1926
Physical Description	6 p.; 25 cm
Subject	Bengal—Social Sciences

15

Call No.	182 Pb 925.1
Author/Editor	Ray, Praphullachandra
Title	*Faridapura Pradeshika Hindu Sabhara Sabhapatira Bhasana*
Imprint	Kolkata: Bengal Chemical Press, 1925
Physical Description	7 p.; 25 cm
Subject	Bengal—Social Sciences

16

Call No.	182 Pd 925.11
Author/Editor	Ray, Praphullachandra
Title	*Mithyara sahita aposa o santi kraya: a pamphlet advocating female education, widow re-marriage, abolition of pardah and other social reforms*
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1925
Physical Description	19 p.; 18 cm

Subject	Bengal—Social Sciences
Subject	Education

17

Call No.	182 Mc 927.6
Author/Editor	Ray, Praphullachandra
Title	*Acharya Praphullachandra Rayera prabandha o vaktrtavali: a compilation of the essays of the speeches of the author*
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1927
Physical Description	[xxx], 385 p.; photos; 18 cm
Subject	Bengal—Social Sciences
Subject	Bengal—History and criticism

18

Call No.	182. Pc 932.2
Author/Editor	Ray, Praphullachandra
Title	*Cha-pana o desera sarvanasa: reprint of an article from the 'Basumati' denouncing tea-drinking as undermining national health in Bengal*
Imprint	Kolkata: [s.n.], 1932
Subject	Bengal—Economics
Subject	Nutrition

19

Call No.	182 Cc 931.43
Author/Editor	Ray, Praphullachandra
Title	*Vijnane vangali*
Imprint	Dhaka: Presidency Library, 1935
Physical Description	[x], 204 p.; photos; 18 cm

Subject	Biography
Subject	Bengal—Science

20

Call No.	182. Ec 936.13
Author/Editor	Ray, Praphullachandra
Title	*Khadya vijnan: a treatise on dietetics, with a chapter on the human digestive system*
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1936
Physical Description	[xvi], 304 p.
Subject	Nutrition
Subject	Medicine—History
Added Author	Biswas, Haragopal, jt. aut.

21

Call No.	B 925.4 Ra 597 at
Author/Editor	Ray, Praphullachandra
Title	*Atmacharit*
Imprint	Kolkata: Chuckervertty, Chatterjee & Co., 1937
Physical Description	[2, vi], 357 p.; photos; 22 cm
Subject	Autobiography

22

Call No.	182 Cc 937.19
Author/Editor	Ray, Praphullachandra
Title	*Atmacharit*
Imprint	Calcutta: Chuckervertty, Chatterjee & Co., 1937
Physical Description	[2, vi], 357 p.; photos; 22 cm

Subject	Autobiography

23

Call No.	B 925.4 Ra 597 at (1)
Author/Editor	Ray, Praphullachandra
Title	*Atmacharit*
Edition	2nd ed.
Imprint	Calcutta: Orient Book Co., 1961
Physical Description	[xvi], 448 p.; photos; 22.5 cm
Subject	Autobiography

24

Call No.	K.S. B 540 Ra 597
Author/Editor	Ray, Praphullachandra
Title	*Hindu rasayani vidya*
Imprint	Kolkata: Vivabharati Granthalaya, 1947
Physical Description	[4, vi], 51 p.; 18 cm
Subject	Ancient India—Chemistry

25

Call No.	B 294.55204 Ra 597 j
Author/Editor	Ray, Praphullachandra
Title	*Jatiya muktir pathe antaray*
Edition	Abridged edition
Imprint	Kolkata: Sadharan Brahmasamaj, 1955
Physical Description	[ii], 26 p.; 18 cm
Subject	Bengal—Social Sciences
Subject	History—India—Bengal

26

Call No.	B 891.444 Ra 597 sc
Author/Editor	Ray, Praphullachandra
Title	*Acharya Praphullachandrer prabandha; edited and compiled by Syamal Chakravarti*
Imprint	Kolkata: Ajkal, 2001
Physical Description	205 p.; 22 cm
Subject	Bengali essays
Added Author	Chakravarti, Syamal, edt. com.

27

Call No.	182 Cc 919.18
Author/Editor	Ghosh, Nanigopala
Title	*Praphulla-charita: life of Sir Praphullachandra Ray, the chemist and founder of the Bengal Chemical and Pharmaceutical Works*
Imprint	Kolkata: Kamala Book Depot, 1923
Physical Description	[vi], 43 p.; 19.5 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

28

Call No.	B 920.05414 Bh 545 v
Author/Editor	Bhattacharya, Vijanavihari
Title	*Vanglara manishi*
Imprint	Calcutta: Vrindavana Dhar & Sons, 1940
Physical Description	[vi], 130 p.; 18 cm
Subject	Biographies

29

Call No.	J/B 920.05414 V 469 m
Author/Editor	Vandyopadhyaya, Kanak
Title	*Manishider jivanasmriti*
Imprint	Calcutta: Century Publishers, 1946
Physical Description	105 p.
Subject	Biographies

30

Call No.	J/B 925.4 Ra 597 m.mu
Author/Editor	Mukhopadhyaya, Manmohan
Title	*Manishi Praphullachandra*
Imprint	Calcutta: Book Corporation Ltd., 1947
Physical Description	[iv], 119 p.; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

31

Call No.	J/B 925.4 Ra 597 km
Author/Editor	Mukhopadhyaya, Kananavihari
Title	*Kachi kanchader Praphullachandra Ray*
Imprint	Konnagar: Kolkata Prakashan, 1958
Physical Description	32 p.; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

32

Call No.	J/B 925.4 Ra 597 cw
Author/Editor	Mitra, Khagendranath
Title	*Chhotoder Praphullachandra Ray*

Imprint	Kolkata; Dey's Publishing, 1996
Physical Description	48 p.; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

33

Call No.	B 925.4 Ra 597 ab
Author/Editor	Bagchi, Mani
Title	*Acharya Praphulla Chandra*
Imprint	Kolkata: Jijnasa, 1961
Physical Description	[x], 199 p.; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

34

Call No.	B 925.4 Ra 597 abh
Author/Editor	Bhattacharya, Devipada and others, ed.
Title	*Acharya Praphullachandra janma shatabarsha purti smarak grantha*
Imprint	Kolkata: Khulna Sammilani Shatabarsha Purti Udyapan Samiti, 1961
Physical Description	[ii], 195, 38 p.; 22 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography
Subject	Science—India

35

Call No.	B 925.4 Ra 597 ac
Author/Editor	Bhattacharya, Vijanavihari
Title	*Acharya smarak grantha*

Imprint	Kolkata: Acharya Prafulla Chandra Ray Centenary Celebration Committee, 1963
Physical Description	[xxiv], 112 p.; plates; 24.5 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography
Subject	Science—India

36

Call No.	B 925.4 Ra 597 a.vi
Author/Editor	Visvas, Devendranath
Title	*Acharya Praphullachandra*
Imprint	Calcutta: Vangiya Vijnan Parisad, 1965
Physical Description	[viii], 120 p.; photos; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

37

Call No.	B 925.4 Ra 597 sm
Author/Editor	Mukhopadhyaya, Visvanatha, ed.
Title	*Smriti-sattay Acharya Praphullachandra*
Imprint	Kolkata and Chandannagar: R.K.B.K. Acharya Praphullachandra Sammilani and Chandannagar Charitable Book Bank, 1966
Physical Description	[iii], 343 p.; 22 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography
Subject	Bengali essays

38

Call No.	B 925.4 Ra 579 aca
Author/Editor	Chattopadhyaya, Ratanamani, edt.
Title	*Acharya Praphullachandrer chintadhara*
Imprint	Kolkata: Orient Book Co., 1967
Physical Description	[xviii], 223 p.; 22 cm
Subject	Ray, Praphullachandra, 1861-1944—Intellectual Life
Subject	Bengali essays

39

Call No.	B 925.4 Ra 597 apr
Author/Editor	Biswas, Visva
Title	*Acharya Praphullachandra Ray*
Imprint	Kolkata: Biswas Publishing House, 1971
Physical Description	[viii], 56 p.; 20.5 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

40

Call No.	J.B 925.4 Ra 597 as
Author/Editor	Saha Ray, Ravidas
Title	*Acharya Praphullachandra*
Imprint	Calcutta: Pioneer Publishers, 1987
Physical Description	[iv], 108 p.; 21 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

41

Call No.	B 925.41 Ra 597 a

Author/Editor	Chakravarti, Syamal
Title	*Oitihya uttaradhikar o vijnani Praphullachandra*
Imprint	Kolkata: Sahitya Samsad, 2009
Physical Description	[xvi], 486 p.; plates; photos; facsims; 22 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography
Subject	Bengal—Intellectual life
ISBN	8179551792

42

Call No.	B 925 G 642 v
Author/Editor	Ghose, Anil Chandra
Title	*Vijnane vangali*
Imprint	Kolkata: Presidency Library, [n.d.]
Edition	4th ed.
Physical Description	[x], 200 p.; photos; 21 cm
Subject	Biographies

43

Call No.	B 925.4 Ra 597 a.v
Author/Editor	Vasu, Phanindranath
Title	*Acharya Praphullachandra*
Imprint	Calcutta: Barada Agency, [n.d.]
Physical Description	126 p.; 18 cm
Subject	Ray, Praphullachandra, 1861-1944—Biography

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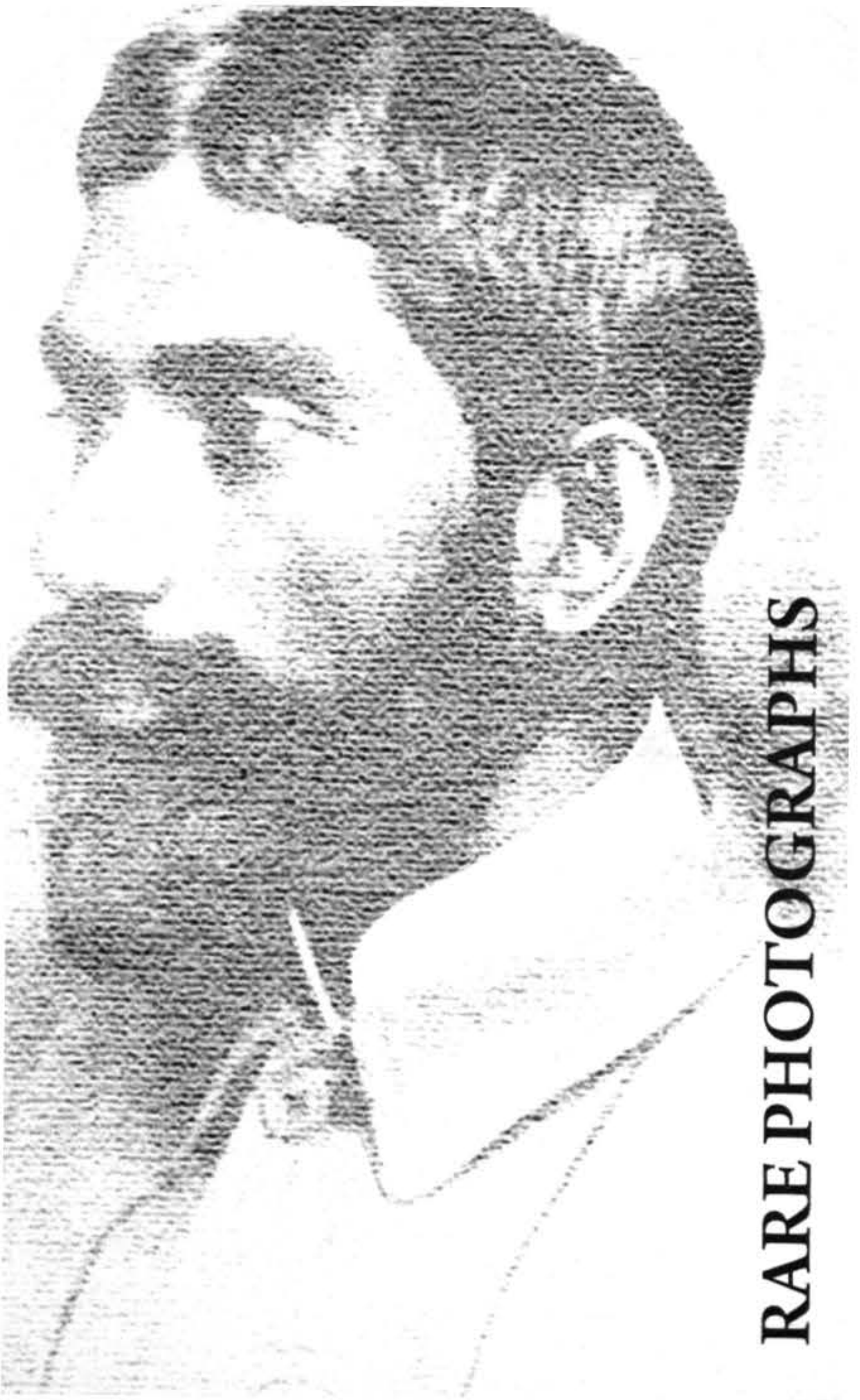


1. Inner Quadrangle of the ancestral house of Ray at Raruli-Katipara

2. Outer Quadrangle of the ancestral house of Ray at Raruli-Katipara

Admitted to Metropolitan College, founded by Iswarchandra Vidyasagar.

1881: Passed First Arts Examination and admitted to the BA course with Chemistry as the major subject.

1882: Awarded the Gilchrist Scholarship and went up to Edinburgh University.

1885: Wrote *India before and after the Mutiny*. Awarded the Bachelor of Science degree of Edinburgh University.

1886: Wrote *Essays on India.*

1887: Awarded the Doctor of Science degree of Edinburgh University for the thesis 'Conjugated (gepaarte) sulphates of the copper-magnesium Group: a study of isomorphous mixtures and molecular combinations'. Won the Hope Prize and the Faraday Gold Medal. Elected Vice-President of Edinburgh Chemical Society.

1888: Published 'On the conjugated sulphates of the copper-magnesium group' in the *Proceedings of the Royal Society of Edinburgh*. Returned to India.

1889: Joined Presidency College as Assistant Professor.

1890-1: Founded Nature Club. Became member of the Executive Committee of Brahmo samaj. Moved house to 91 Upper Circular Road.

1892: Started research on indigenous medicinal plants and took initial steps toward setting up Bengal Chemical and Pharmaceutica Works.

1894: Visited Europe. Death of father. Published 'On the chemical examination of certain Indian foodstuffs. Part I, Fats and oils', in the *Journal of the Asiatic Society of Bengal*, 63, Part II (1894).

1895: Discovery of mercurous nitrite.

1899: Published 'Problem of scientific education in India', in *Calcutta Review*, 108 (1899).

1901: Introduced to Gokhale and Gandhi. Bengal Chemical and Pharmaceutical Works Ltd. incorporated as a limited company.

1902: First volume of *A history of Hindu chemistry* published. *Saral prānivijnān* published by Bangiya-Sahitya-Parishat.

1904: Another trip to England and Europe. Death of mother.

1905: Maniktala factory of Bengal Chemical established.

1906: *Navya rasāyanividyā o tāhār utpatti* published by Bangiya-Sahitya-Parishat.

1907: Elected President of the National Council of Education, Bengal.

1908: Felicitated by the University of Calcutta. President of the Bengali Literary Conference in Rajsahi. Promoted a co-operative bank in his native village.

1909: The second volume of *A history of Hindu chemistry* published. Wrote the text-book *Elementary inorganic chemistry*.

1910: *Bāngālir mastishka o tār apavyavahār* published in Bengali and English. *Rasārnava*, edited by Ray and Harischandra Kaviratna published.

1911: Founded Maidan Club for informal discussions with Girischandra Basu, Debaprasad Ghosh, Pranakrisna Acharya and others as members.

1912: Visited England with Debaprasad Sarbadhikary. Awarded the title of Companion of the British Empire. Urged the British government to establish more institutions of higher learning in India.

1913: President of the science section of the Bengali Literary Conference. Protested against the discriminatory policy in education.

1914-15: Lectured at Punjab University.

1916: Retired from Presidency College. Joined Calcutta University as Palit Professor of Chemistry. Advocated the teaching of science in Bengali at the Bengal Provincial Literary Conference in Jasore.

1917: Delivered address against untouchability at the 31st meeting of the Indian Reform Association. Set up a co-operative for the workers of Bengal Chemical.

1918: Published *Essays and Discourses*. Founded a college in Bagerhat. Lectured at the University of Madras.

1919: Spoke against the Rowlatt Bill at the Town Hall, Kolkata. Appointed Director of Bengal Potteries Limited. Awarded knighthood. Elected honorary fellow of Deutsche Akademie, Munich. *Rāsāyanik paribhāsā* published by Bangiya-Sahitya-Parish (co-author Prabodhchandra Chattopadhyaya).

1920: Presided over the seventh Indian Science Congress in Nagpur and delivered the address entitled 'Dawn of science in modern India'. Conferred honorary doctorates by the Universities of Dhaka and Benaras. Visited Europe.

1921: Instituted a scholarship of Rs 200 per month for research and pledged his savings to the department of Chemistry at the University of Calcutta. Organized Relief Committee for the famine in Khulna. Presided over the first conference of the All Bengal Teachers Association. Elected President of Bengal Co-operative Organization.

1922: Organized flood relief in north Bengal. Donated Rs 10,000 to the University of Calcutta to institute the Nagarjuna Award. Took active part in defending the autonomy of the University at the meeting at Senate Hall on 8 December. Joined Gandhi's campaign in favour of the *charkha*.

1923: Spoke at the convocation at Aligarh Muslim University and at the third annual meeting of the Khulna District Co-operative. Joined the meeting of the Congress at Faridpur with Gandhi and C. R. Das.

1924: Founded the Indian Chemical Society, and delivered the inaugural address entitled 'Chemical knowledge of the Hindus of old' at the first annual general meeting of the Society held at Benaras Hindu University. Donated Rs 10,000 for the building of the Society and was elected the first President. Delivered address as President of the Reception Committee at the eighth conference of the Faridpur District Hindu Mahasabha.

1925: Published *Makers of modern chemistry*. Visited Santiniketan. Lectured at Nagpur University and the Adharchandra Mukhopadhyaya Lecture at the University of Calcutta.

1926: Delivered the Presidential address at the second annual general meeting of the Indian Chemical Society in Mumbai entitled *The discovery of oxygen*. *The discovery of oxygen* published by the University of Calcutta. Delivered Presidential address at the first meeting of the Rural Welfare Association. Delivered convocation address at the University of Mysore and the Presidential address at the All Bengal College and University Teachers' Conference.

1927: Participated in the All India Education Conference in Varanasi. Donated a substantial sum for the spread of women's education after the reconstruction of Jenana Sammilani in Jasore.

1929: Represented the University of Calcutta at the Congress of the Universities of the Empire at Cambridge. Criticized British policy in higher education. Inaugurated the exhibition of the Indian National Congress at Lahore. Presided over the Provincial Co-operative Conference in Mumbai.

1930: Spoke at the *swadeshi* fair at Chennai. Delivered convocation address at Benaras Hindu University. Spoke at the Classified Trade Organization in Mumbai.

1931: Inauguration of new plant of Bengal Chemical at Panihati. First appeal to prospective shareholders in favour of Banga Sree Cotton Mills Limited. Elected President of the Bangiya-Sahitya-Parishat. Spoke at the *khādi* exhibition at Tiruchirapalli, the *swadeshi* fair at Pune, and inaugurated the national trade fair at Karachi. Organized flood relief in north and east Bengal.

1932: Published the first volume of *Life and experiences of a Bengali chemist*. Started to publish the serialized essay 'The Shakespearean Puzzle' in *The Calcutta Review*. Felicitated by the Municipal Corporation and eminent citizens on the occasion of his 70th birthday, with Rabindranath Tagore as Chairperson. Lectured at Nagpur University on the development of Indian industry. Banga Sree Cotton Mills started production.

1933: Delivered Presidential address at the State Youth Conference at Travancore. Inaugurated the *swadeshi* fair in Indore. Inaugurated the industrial fairs in Delhi and Karachi. Felicitated by the municipal corporation of Karachi. Delivered convocation address at Annamalai University. Organized meeting in Medinipur to campaign for the right of untouchables to enter temples. Wired the British Prime Minister for the release of political prisoners.

1934: Founded Khulna Cotton Mill. Nominated fellow of the Chemical Society of London. Delivered Presidential address at the conference of Indian insurance companies at Lahore. Consented to chair the Indian Science News Association. Conferred honorary doctorate by University of Dhaka. Joined the protest against the policy of communal award.

1935: Published the second volume of *Life and experiences of a Bengali chemist.* Started a series of discussions entitled Bengal Initiative for the development of industry and commerce. Participated in the educational conference at Wardha.

1936: Presided over the 15th Prabāsi (non-resident) Bengali Literary Convention at Patna. Donated Rs 10,000 to the University of Calcutta for instituting Sir Asutos Mukhopadhyaya Memorial Prize. Retired from the post of Palit Professor. Appointed Professor Emeritus. Delivered Presidential address at the conference of the Brahmo samaj in Tangail. Signatory to the call for a World Peace Conference at Brussels. Supported the Bangiya Byakti Swadhinatā Sangha (Bengal Association for Individual Freedom).

1937: Published *Ātmacharit.* Published *Visvavidyālayer takmā o shilpa byabsāye krititvalābh.* Spoke at the silver jubilee celebration of the Marwari Education Society at Wardha.

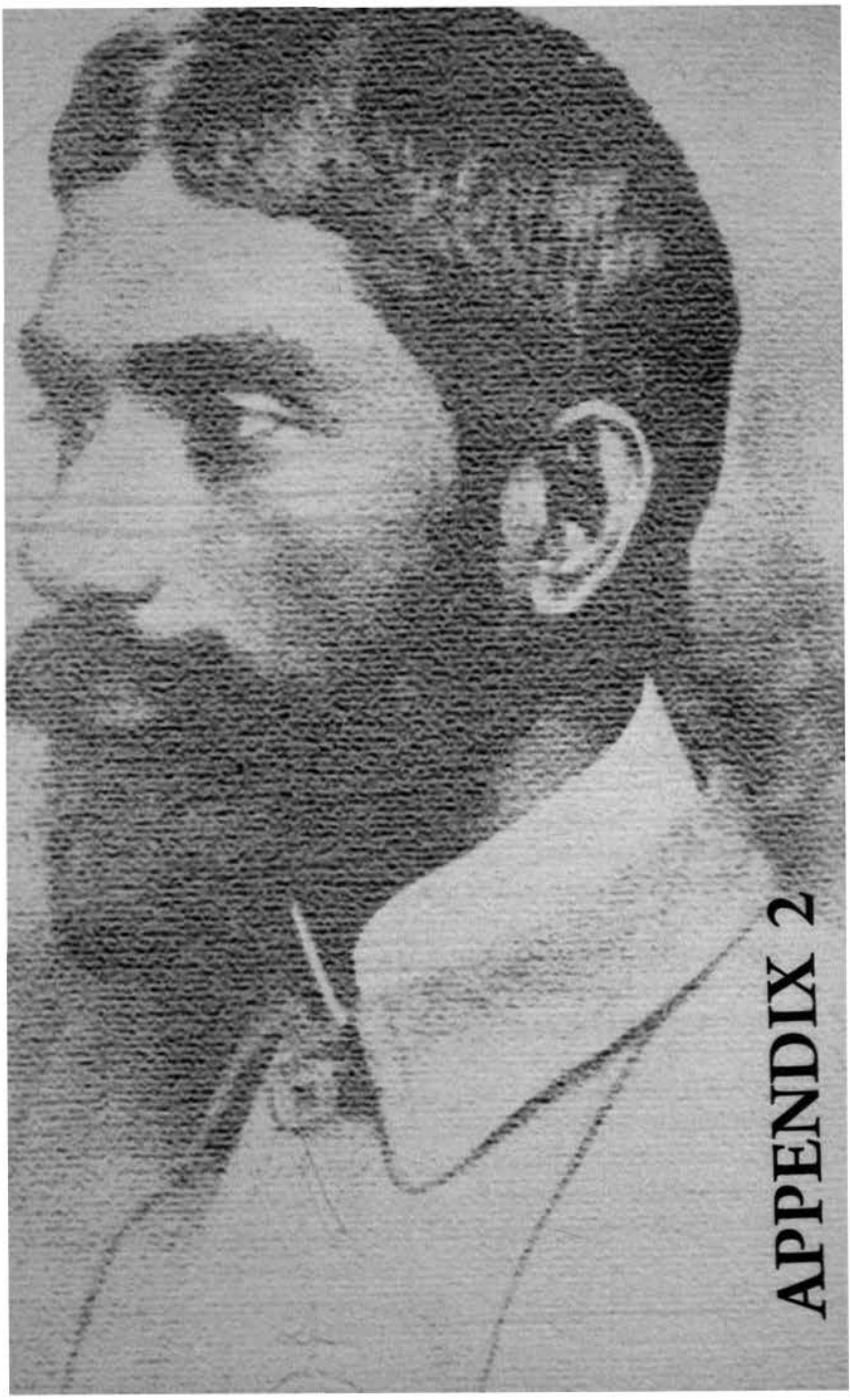
1938: Founded Indian Chemical Manufacturers Association and elected President.

1940: Resigned from the Chairmanship of Bengal Chemical.

1941: Felicitated at the Senate Hall on his 80th anniversary. Signed a statement of protest against the German invasion of the Soviet Union.

1943: Felicitated by the residents of Khulna and Raruli.

1944: Died on 16 June.



APPENDIX 2

Research papers of Praphullachandra Ray

1888: 'On the conjugated sulphates of the copper-magnesium group', *Proceedings of the Royal Society of Edinburgh* Vol. 15 (1888), 267-83

1894: 'On the chemical examination of certain Indian foodstuffs. Part I, Fats and oils', *Journal of the Asiatic Society of Bengal*, 63, Part II (1894), 59-80

1896: 'On mercurous nitrite', *Journal of the Asiatic Society of Bengal*, 65 (1896), 1-9; 'Mercury hyponitrites' and 'The interaction of mercurous nitrite and the alkyl iodides', *Proceedings of the Chemical Society*, 12 (1896), 217-18, 218

1897: 'The nitrites of mercury and the varying conditions under which they are formed', 'Mercury hyponitrites', 'On the action of sodium of hyponitrite on mercuric solution', and 'On a new method of preparing mercuric hyponitrite', *Journal of Chemical Society*, 71 (1897), 337-44, 348-50, 1097-1104, 1104-6

1899: 'On the interaction of mercurous and mercuric nitrites with the nitrites of silver and sodium', 'The interaction of mercurous nitrite with ethyl iodide', and 'On mercurous iodide', *Proceedings of the Chemical Society* (1899), 103, 239.

1900: 'Further researches on mercurous nitrite and its derivatives II. On mercurous iodide and a new method of its preparation', *Journal of the Asiatic Society of Bengal*, 69 (1900), 476-88

1901: 'A new series of dimercuri ammonium salts. Part I', *Proceedings of the Chemical Society*, 16 (1901), 96; 'Über mercuronitrit', *Annalen der Chemie*, 115 (1901), 250-6

1902: 'Dimercurammonium nitrite and its haloid derivatives', *Journal of Chemical Society*, 81 (1902), 644-50

1903: 'A study of the constitution of dimercurammonium nitrate', and 'Dimercurammonium nitrate', *Journal of the Asiatic Society of Bengal*, 72 (1903), 1-4; 4; 'Decomposition of mercurous nitrite by heat' (co-author Jatindranath Sen), *Journal of Chemical Society*, 83 (1903), 491-4

1904: 'Mercuric nitrite and its decomposition by heat', in the *Journal of Chemical Society*, 85 (1904), 523-7

1905: 'The sulphate and the phosphate pf the dimercurammonium series', 'Theory of the production of mercurous nitrite and of its conversion into various mercury nitrates', and 'The nitrites of the alkali metals and metals of the alkaline earths and their decomposition by heat' (co-author Atulchandra Ganguli), *Journal of Chemical Society*, 87 (1904), 9-10, 171-7, 177-84; 'The constitutions of nitrites. Part I. Two varieties of silver nitrite' (co-author Atulchandra Ganguli) in the *Proceedings of the Chemical Society* (1905), 278

1906: 'Fischer's salt and its decomposition by heat' (co-author Atulchandra Ganguli), and 'The interaction of alkyl sulphates with nitrites of the alkali metals and metals of the alkaline earths' (co-author Panchanan Neogi), *Journal of Chemical Society*, 89 (1906), 551-6, 1900-5

1907: 'The decomposition of mercurous and silver hyponitrites by heat' (co-author Atulchandra Ganguli), 'Mercurous hyponitrite', 'Cupric nitrite', 'The decomposition of hyponitrous acid in presence of mineral acids' (co-author Atulchandra Ganguli), 'The double nitrites of mercury and the alkali metals', and 'Silver-mercuroso-mercuric oxynitrates and the isomorphous replacement of univalent mercury by silver', *Journal of Chemical Society*, 91 (1907), 1399-1403, 1404-5, 1405-7, 1866-70, 2031-3, 2033-7; 'Preparation of aliphatic nitro-compounds by the interaction of alkyl iodides and mercurous nitrite' (co-author Panchanan Neogi), *Proceedings of the Chemical Society* (1907), 246; 'Notes from the chemical laboratory of the Presidency College. Note no. 3 on silver-mercuroso-mercuric nitrate', *Journal of the Asiatic Society of Bengal*, Vol. 3 (1907), 137-8

1908: 'Molecular volumes of the nitrites of silver, mercury and the alkali metals', *Journal of Chemical Society*, 93 (1908), 997-1000; 'Molecular volumes of the nitrites of silver, mercury and the alkali metals', and 'Lithium nitrite and its decomposition by heat', *Proceedings of the Chemical Society* (1908), 75; 'On the retardation and acceleration in the dissolution of mercury in nitric acid in the presence of minute traces of ferric nitrate and manganous nitrate', *Journal of the Asiatic Society of Bengal*, Vol. 4 (1908), 405

1909: 'Interaction of phosphorus halides and arsenious and arsenic compounds' (co-author Nagendranath Sen), *Journal of the Asiatic Society of Bengal*, Vol. 5 (1909); 263-5; 'The molecular volumes of the nitrites of barium, strontium and calcium', and 'The decomposition and sublimation of ammonium nitrite', *Journal of Chemical Society*, 95 (1909), 66-9, 345-9

1910: 'Decomposition of dimercurammonium nitrite by heat' (co-author Atulchandra Ghosh), and 'The double nitrites of mercury and the metals of the alkaline earths', *Journal of Chemical Society*, 97 (1910); 323-5, 326-7; 'The double nitrites of mercury and the bases of the tetraalkylammonium series', and 'Ionisation of the nitrites as measured by the cryoscopic method' (co-author Satischandra Mukherjee), *Proceedings of the Chemical Society*, 26 (1910), 172, 173-4

1911: 'Influence of minute quantities of ferric salts and of manganese nitrate on the rate of solution of mercury nitric acid', 'Methylammonium nitrite' (co-author Jitendranath Rakshit), 'Tetramethylammonium hyponitrite and its decomposition by heat' (co-author Hemendrakumar Sen), 'Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite' (co-author Jitendranath Rakshit), 'Nitrites of the benzylammonium nitrite and dibenzylammonium nitrite and their sublimation and decomposition by heat' (co-author Rasiklal Datta), and 'Trimercuri diethylammonium nitrite', *Journal of Chemical Society*, 99 (1911), 1012-16, 1016-18, 1466-70, 1470-5, 1475-7, 1972-3

1912: 'Nitrites of the alkylammonium series. Part II. Propylammonium nitrite and butylammonium nitrite and their decomposition by heat' (co-author Jitendranath Rakshit), 'Nitrites of the alkylammonium series. Part III. Triethylammonim nitrite and its decomposition and sublimation by heat' (co-author Jitendranath Rakshit), 'Nitrites of the alkylammonium series. Part IV. Isobutyl- diethyl-, dipropyl-, and tripropylammonium nitrites'(co-author Jitendranath Rakshit), 'Nitrites of the mercurialkyl and mercuri-alkylamylammonium series' (co-authors Jitendranath Rakshit and Rasiklal Datta), 'The molecular conductivities of potassium nitrite, mercuric nitrite, and potassium mercurinitrite' (co-author Nilratan Dhar), 'The vapour density of ammonium nitrite'(co-authors Nilratan Dhar and Tinkari De), and 'Nitrites of the mercurialkyl and mercuryalkylaryl ammonium series. Part II.' (co-authors Nilratan Dhar and Tinkari De) in the *Journal of Chemical Society*, 101 (1912) 141-3, 216-19; 612-16, 616-20, 965-8, 1185-9, 1552-7; 'Nitrites of the alicyclic ammonium series. Part I. Nitrosopiperazinium nitrite' (co-author Jitendranath Rakshit), 'The molecular conductivities of potassium nitrite, mercuric nitrite, and potassium mercurinitrite' (co-author Nilratan Dhar), 'Benzylmethyl-, benzylethyl-, and allyl-ammonium nitrites' (co-author Rasiklal Datta), 'Chlorides of the mercurialkyl- and mercurialkylaryl-ammonium series, and their constitution as based on conductivity measurements' (co-author Niratan Dhar), and 'On sodium diacetamide and potassium acetamide', *Proceedings of the Chemical Society*, 28 (1912), 102, 102, 258, 292, 305; 'Allylammmonium nitrite' (co-author Rasiklal Datta), 'On isomeric allylamines' (co-author Rasiklal Datta), 'Piperazinium nitrite' (co-author Jitendranath Rakshit), and 'On second allylamines' (co-author Rasiklal Datta; second communication), *Journal of the Asiatic Society of Bengal*, 8 (1912), 101-2, 103, 107, 371-2

1913: 'Nitrites of the alicyclic ammonium series. Nitropiperazinium nitrite' (co-author Jitendranath Rakshit), 'Chlorides of the mercurialkyl- and mercuri-alkyaryl- ammonium series and their constitution as based on conductivity measurements' (co-author Nilratan Dhar), 'Equivalent conductivity and ionisation of nitrites' (co-author Nilratan Dhar), 'Equivalent conductivities of sodium hyponitrite, calcium hyponitrite and hyponitrous acid' (co-authors Rajendralal De and Nilratan Dhar), and 'The vapour density of ammonium nitrate, benzoate and acetate' (co-author Saratchandra Jana), *Journal of Chemical Society*, 103 (1913), 1-3, 3-10, 10-18, 1562-4, 1565-8

1914: 'Action of monochloro-acetic acid on thiocarbamide and monoalkylated thiocarbamides' (co-author Francis Vito Fernandes), *Journal of Chemical Society*, 105 (1914), 2159-61; 'Additive and substitutive compounds of mercuric nitrite with organic thio-derivatives. Part I', 'Action of nitrous acid on dimethylpiperazine', and 'The action of mercuric, cupric and platonic chlorides on organic sulphur compounds', *Proceedings of the Chemical Society*, 30 (1914), 140, 143-5, 304; 'The place of mercury in the periodic system', and 'Action of nitrous acid on dimethylpiperazine', *The Chemical News*, 103 (1914), 85, 272-4

1915: 'Interaction of dimercuriammonium nitrite and the alkyl iodides', *Journal of Chemical Society*, 107 (1915), 1251-4

1916: 'Molecular volumes of the hyponitrites of the alkali metals and metals of the alkaline earths' (co-author Rajendralal De), 'Nitromercaptides and their reaction with the alkyl iodides. Compounds of the disulphonium series', 'Mercury mercaptide nitrites and their reaction with the alkyl iodides. Part II', and 'Interaction of iodine and thioacetamide in aqueous and alcoholic solution' (co-author Maniklal Dey), *Journal of Chemical Society*, 109 (1916), 122-31, 131-8, 603-12, 698-701

1917: 'Mercury mercaptide nitrites and their reaction with the alkyl iodides. Part III. Chain compounds of sulphur', 'Cadmium and zinc nitrites', 'Velocity of decomposition and the dissociation constant of nitrous acid' (co-authors Maniklal Dey and Jnanendrachandra Ghosh), 'Alkoidal derivatives of mercuric nitrite', and 'Synthesis of abthiocrotonic acid' (co-author Maniklal Dey), *Journal of Chemical Society*, 111 (1917), 101-9, 159-62, 313-17, 507-10, 510-12

1919: 'Mercury mercaptide nitrites and their reaction with the alkyl iodides, Part IV. Chain compounds of sulphur (continued)' (co-author Praphullachandra Guha), 'Mercury mercaptide nitrites and their reaction with the alkyl iodides, Part V. Chain compounds of sulphur (continued)' (co-author Praphullachandra Guha), 'Mercury mercaptide nitrites and their reaction with the alkyl iodides, Part VI. Chain compounds of sulphur (continued)', 'Mercuric sulphoxychloride' (co-author Praphullachandra Sen), 'Interaction of sulphuric and cupric chlorides respectively and the mercaptans and potential mercaptans', 'Mercury mercaptide nitrites and their reaction with the alkyl odides, Part VII. Chain compounds of sulphur (continued)' (co-author Praphullachandra Guha), and 'Reaction of the potassium salts of 2-thiol 5-thio-4-phenyl-4 1-4:5 dihydro – 1:3:4-thiodizole and 2:5-dithiol—1:3:4 –thiodizole with halogenated organic compounds (co-author Praphullachandra Guha and Radhakisen Das), *Journal of Chemical Society*, 115 (1919), 261-71, 541-8, 548-52, 552-6, 871-8, 1148-55, 1308-12

1920: 'Triethylene tri- and tetra- suphides', *Journal of Chemical Society*, 117 (1920), 1090-2

1921: 'The molecular conductivity of some sulphonium compounds in acetone' (co-author Kalikumar Kumar), *Journal of Chemical Society*, 119 (1921), 1643-4

1922: 'Chloropicrin as a reagent for the diagnosis mercaptans and potential mercaptans' (co-author Radhakisen Das), 'Triethylene tri- and tetra-sulphides, Part II', *Journal of Chemical Society*, 121

(1922), 323-8, 1279-83

1923: 'Varying valency of platinum with respect to mercaptanic radicles', 'Mercaptans of the purine group, Part I' (co-authors Gopalchandra Chakravarti and Praphullakumar Bose), and 'Triethylene tri- and tetra-sulphides, Part III. The sulphones, sulphinic and sulphonic acids of the series. Extension of Stuffer's Law', *Journal of Chemical Society*, 123 (1923), 133-41, 1957-62, 2174-8

1924: 'Synthesis of cyclicpolysulphides, Part I. Condensation of dithioethylene glycol with benzylidene chloride', *Journal of Chemical Society*, 125 (1924), 1141-4, 'Varying valency of gold with respect to mercaptanic radicles, Part I', 'The oxidation triethylene tetrasulphide by means of potassium permanganate', and 'Chemical knowledge of the Hindus of old', *Journal of Indian Chemical Society*, 1 (1924), 63-73, 207-12, 225-34

1925: 'Varying valency of platinum with respect to mercaptanic radicles, Part II', (co-author Kshitischandra Bose Ray), *Journal of Indian Chemical Society*, 2 (1925), 178-90

1926: 'The discovery of oxygen', 'Synthesis of condensed heterocyclic systems: interaction between 2:5-dithiol-1:3:4-thiodiazole and some organic dihalides' (co-author Bireschandra Guha), 'On triethylene trisulphide and 1:4 dithian' (co-author Kshitischandra Bose Ray), 'Lengthened chain compounds of sulphur' (co-author Kshitischandra Bose Ray), 'Varying valency of platinum with respect to mercaptanic radicles, Part III' (co-authors Bireschandra Guha and Kshitischandra Bose Ray), and 'Varying valency of platinum with respect to mercaptanic radicles, Part IV. The inadequacy of Werner's theory to explain certain anomalous cases' (co-authors Bireschandra Guha and Kshitischandra Bose Ray), *Journal of Indian Chemical Society*, 3 (1926), 1-22, 23-9, 73-4, 75-80, 155-60, 358-70

1927: 'On a new series of double sulphates of the copper-magnesium group and the sulphonium bases' (co-author

Nirmalendunath Ray), 'On the variability of valency', and 'Varying valency of platinum with respect to mercaptanic radicles, Part VI' (co-authors Kshitischandra Bose Ray and Nadiabihari Adhikari), and *Journal of Indian Chemical Society*, 4 (1927), 37-42, 89-95, 467-75; 'Lengthened chain compounds of sulphur', *Nature*, 119 (1927), 124

1928: 'On a new series of double sulphates of the copper-magnesium group and the sulphonium bases, Part II' (co-author Nirmalendunath Ray), 'Varying valency of platinum with respect to mercaptanic radicles, Part VII' (co-authors Kshitischandra Bose Ray and Sachindranath Raychaudhuri), 'Complex compounds of gold with mercaptanic radicles, Part II. Residual affinities of chlorauric acid' (co-author Kshitischandra Bose Ray), and 'Tetraethylphosphonium nitrite' (co-author Nirmalendunath Ray), *Journal of Indian Chemical Society*, 5 (1928), 69-72, 139-47, 527-33, 733-4

1929: 'On a new series of double sulphates of the copper-magnesium group and the sulphonium bases, Part I' (co-author Nirmalendunath Ray), 'Synthesis of lengthened sulphur chain compounds' (co-author Susilkumar Mitra), and 'Action of bases on complex compounds derived from organic thio-compounds and platinic chloride (co-author Purnachandra Ray), *Journal of Indian Chemical Society*, 6 (1929), 27-30, 865-9, 885-91; 'Eine neue art komplexer platinverbindungen. Drei-und fiünfwertiges platin' (co-author Kshitischandra Bose Ray), *Zeitschrift fuer anaorganische und allgemeine Chemie* 1929, 178 (1929), 329-36; 'Isomorphism and homology', *Nature*, 124 (1929), 480-1

1930: 'The chemical elements and compounds', 'Studies on the complexes of the chlorides of gold with organic sulphides' (co-author Dineschandra Sen), and 'Complexes of mercuric iodide with alkyl sulphonium iodides' (co-author Nadiabihari Adhikari), *Journal of Indian Chemical Society*, 7 (1930), 1-9, 67-77, 297-303; 'Eine neue Art komplexer Platinverbindungen Drei-und fiünfwertiges Platin (2. Abhandlung, Teil I und II)' (co-author Saileschandra Sengupta), and 'Komplexverbindungen der chloroferrisäure mit organischen schwefelverbindungen' (co-author Purnachandra Mukherjee), *Zeitschrift fuer anaorganische und allgemeine Chemie* 1929, 187 (1930), 33-48, 121-6; 'Isomorphism and chemical homology', *Nature*, 126 (1930), 310-11

1931: 'Eine neue Art komplexer Platinverbindungen drei-und fünfwertiges Platin (3. Abhandlung)', (co-author Saileschandra Sengupta), *Zeitschrift fuer anaorganische und allgemeine Chemie* 1929, 198 (1931), 53-6; 'Complexes of antimony halides with sulphonium halides' (co-authors Nadiabihari Adhikari and Amarendranath Ray), 'Compounds of metallic salts with organic sulphides', 'Studies on the reaction of silver nitrate with organic sulphides', (co-authors Nadiabihari Adhikari and Harendranath Ray), 'Complexes of antimony trichloride with organic sulphides' (co-authors Nadiabihari Adhikari and Amarendranath Ray), and 'Complexes of zinc and cadmium iodides with alkyl sulphonium iodides' (co-authors Nadiabihari Adhikari and Sanatkumar Banerjee), *Journal of Indian Chemical Society*, 8 (1931), 251-5, 537-40, 689-93, 711-16, 739-51

1932: 'Complex compounds of iridium. Part I. Compounds with organic sulphides' (co-author Nadiabihari Adhikari), *Journal of Indian Chemical Society*, 9 (1932), 251-7; 'Eine neue Art komplexer Platinverbindungen Drei-und fünfwertiges Platin. IV' (co-author Saileschandra Sengupta), *Zeitschrift fuer anaorganische und allgemeine Chemie* 1929, 203 (1932), 401-4

1933: 'Eine neue art komplexer platinverbindungen dreiund fünfwertiges platin. (V. Abhandlung)' (co-author Saileschandra Sengupta), and 'Komplexe platinverbindungen mit Drei-und fünfwertiges Platin. VI' (co-author Nripendranath Ghosh), *Zeitschrift fuer anaorganische und allgemeine Chemie*, 211, 215 (1933), 62-4, 201-4; 'Thioketonic esters, Part III. Alkylation of ethyl thioacetoacetate' (co-authors Susilkumar Mitra and Nripendranath Ghosh), and 'Complex compounds of iridium. Part II. Compounds of organic sulphides and pyridine' (co-authors Nadiabihari Adhikari and Ranajit Ghosh), *Journal of Indian Chemical Society*. 10 (1933), 75-9, 275-9; 'A new fluorination of organic compounds', and 'Fluorination of organic compounds: monofluoracetone' (co-authors P. B. Sarkar and Amit Ray), *Nature*, 132 (1933), 173, 749-50

1934: 'Complex compounds of iridium. Part III. Compounds with ammonia and ethylamine' (co-author Nadiabihari Adhikari), and 'Varying valency of platinum with respect to mercaptanic radicals, Part VIII' (co-author Nripendranath Ghosh), *Journal of Indian Chemical Society*, 11.2 (1934), 517-20, 737-42; 'Eine neue Art komplexer Platinverbindungen Drei-und fünfwertiges Platin. VII' (co-author Nripendranath Ghosh), *Zeitschrift fuer anaorganische und allgemeine Chemie*, 220 (1934), 247-9; 'Isomorphism and chemical constitution: constitution of formic acid and formates', and 'Synthesis of thiocamphor and other cyclic thioketones', *Nature*, 134 (1934), 133-4, 1010

1935: 'On the fluorination of organic compounds. Part I' (co-authors Harischandra Goswami and Anilchandra Roy), *Journal of Indian Chemical Society*, 12 (1935), 93-5

1936: 'Synthesis of two isomeric bis-thiocamphors', *Nature*, 138 (136), 548; 'Complex compounds of iridium. Part IV' (co author Nripendranath Ghosh), and 'On the fluorination of organic compounds. Part II' (co-author Anilchandra Roy), *Journal of Indian Chemical Society*, 13 (1936), 138-40, 427-8

1937: 'Progress of chemistry in ancient India', *Science and Culture*, 2 (1937), 497

1939: 'Separation of the coagulating principle from the other active substances in the venom of Vipera Russelli' (co-author B. N. Ghosh and S. S. De), *Science and Culture*, 4 (1939), 738

Source (with minor revisions): Shyamal Chakravarti, *Oitihya uttaridhikār o vijnāni Praphullachandra* (Kolkata: Sahitya Samsad, 2009), pp. 37-45, 99-106

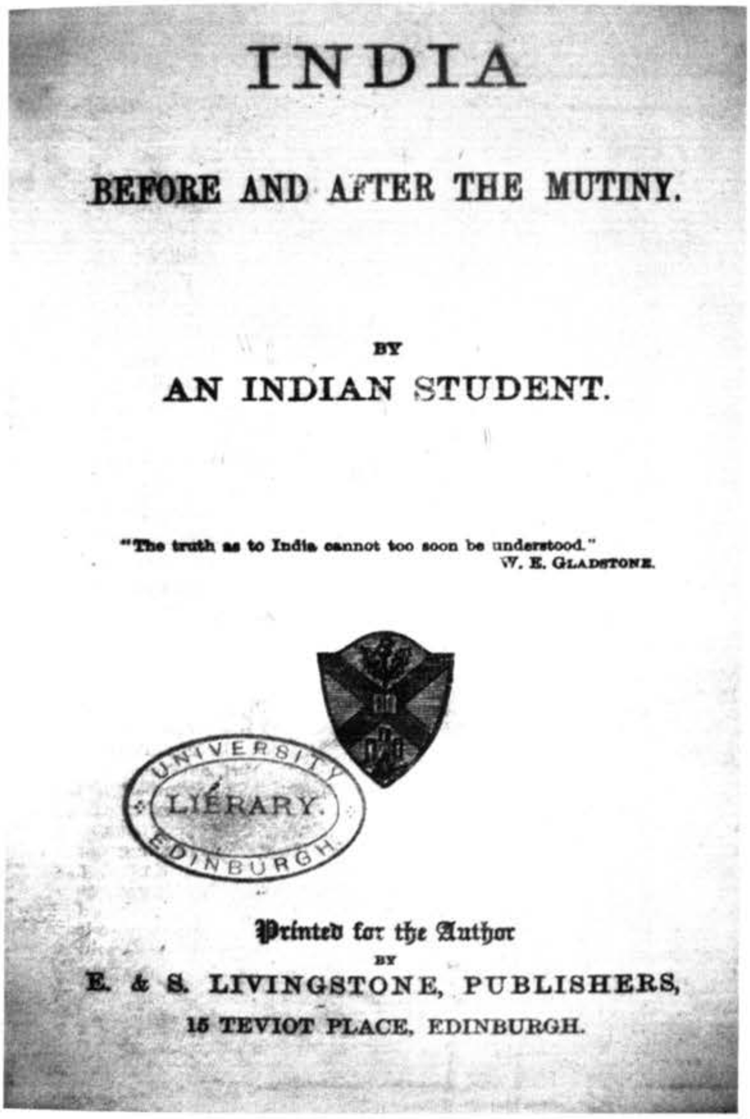
A LIFE DEDICATED TO HUMANITY

ACHARYA RAY

After days of grave illness Acharya Prafulla Chandra passed away on the 16th June 6-30 p.m. last year. This marked the end of a career which trailed clouds of glory behind it. For well over the last half-century he was the moral guardian to enlightened freedom. He preached industrialisation as a weapon to fight poverty and himself showed the way by building up the "Bengal Chemical." Symbol of Bengal's ancient ideal of high thinking and plain living he gave his all to the country.

3. House at 132 Amherst Street in Kolkata where Ray lived with his parents in his schooldays

4. House at 91 Upper Circular Road in Kolkata where Ray lived after joining the Presidency College till his retirement from Government service (1889- 1916)



INDIA

BEFORE AND AFTER THE MUTINY.

BY

AN INDIAN STUDENT.

"The truth as to India cannot too soon be understood."
W. E. GLADSTONE.

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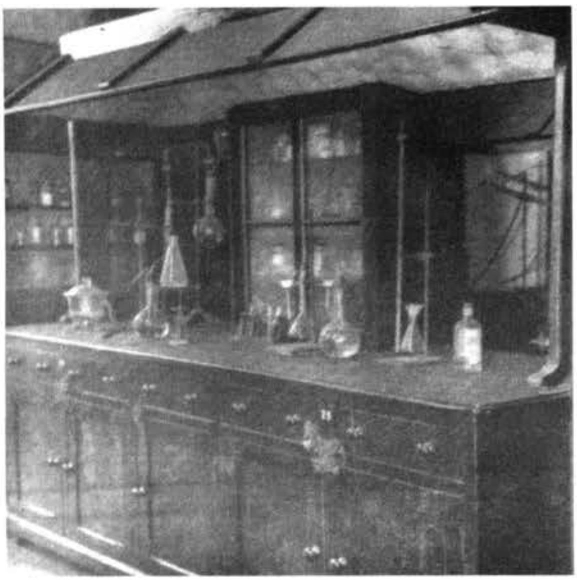
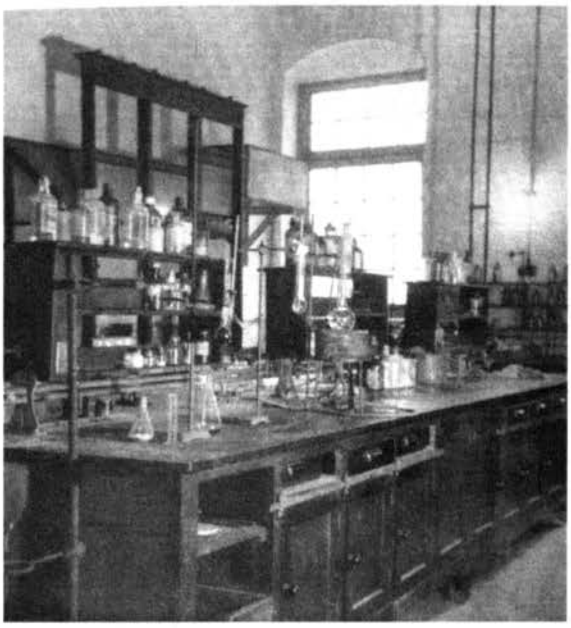
5. Facsimile of the title page of Ray's essay published in Edinburgh (1885)



6. Presidency College Chemical Laboratory where Ray used to work

7. Ray's sitting room at Presidency College

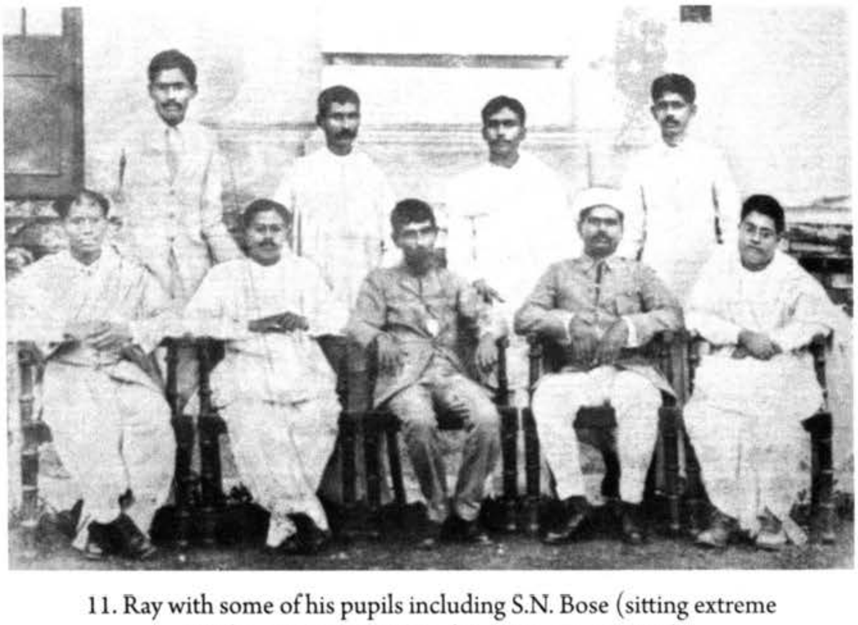


8. Ray's laboratory at the University College of Science

9. Ray with Acharya Jagadish Chandra Bose along with some students of the Presidency College in 1907

বঙ্গীয় সাহিত্য সম্মিলন।
(২য় বর্ষ) রাজসাহী।

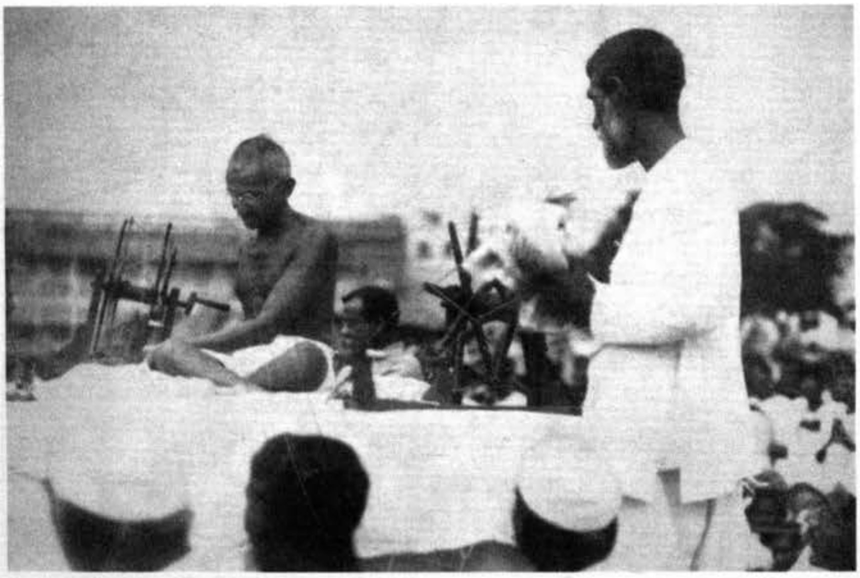
10. Ray presiding over the Bengali Literary Conference at Rajshahi (1908)



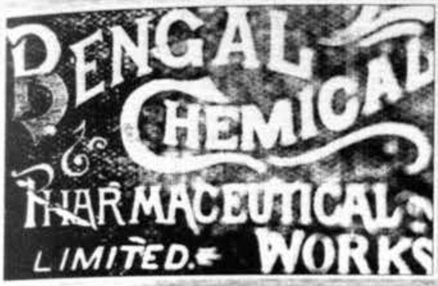
11. Ray with some of his pupils including S.N. Bose (sitting extreme right) and Meghnad Saha (standing extreme left)

12. Ray in 1918

13. Ray at the Bengal Chemical and Pharmaceutical Works Ltd. with its Board of Directors (1924)

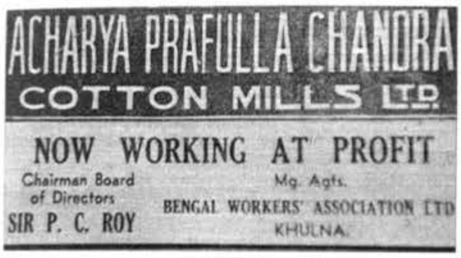


14. Ray with Mahatma Gandhi at the *shradha-basar* of C.R. Das in 1925



BENGAL CHEMICAL & PHARMACEUTICAL WORKS LIMITED.

15. Logo of
Bengal Chemical and Pharmaceutical Works Ltd.

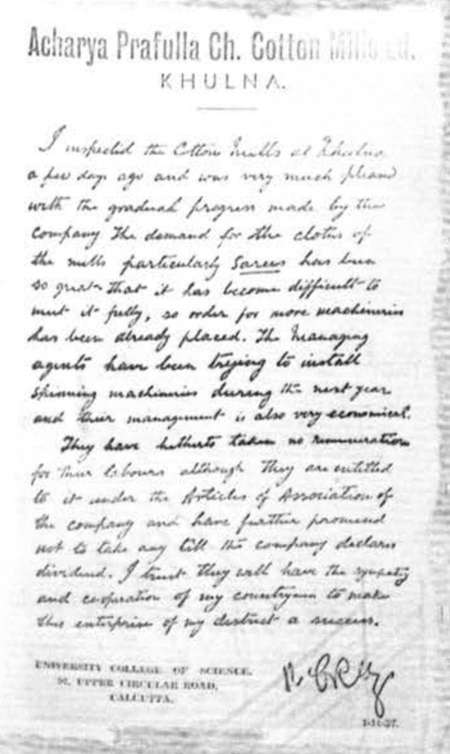


ACHARYA PRAFULLA CHANDRA
COTTON MILLS LTD.

NOW WORKING AT PROFIT

Chairman Board
of Directors
SIR P. C. ROY

Mg. Agts.
BENGAL WORKERS' ASSOCIATION LTD
KHULNA.



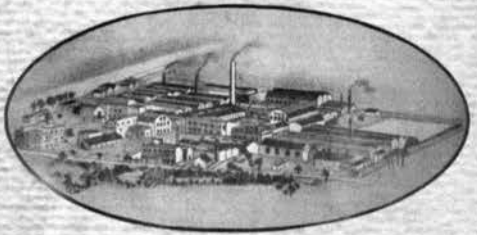
Acharya Prafulla Ch. Cotton Mills Ltd.
KHULNA.

I inspected the Cotton Mills at Khulna a few days ago and was very much pleased with the gradual progress made by the company. The demand for the cloths of the mills particularly Sarees has been so great that it has become difficult to meet it fully, so order for more machineries has been already placed. The managing agents have been trying to install spinning machineries during the next year and their management is also very economical.

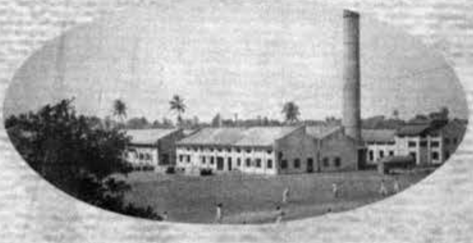
They have hitherto taken no remuneration for their labours although they are entitled to it under the Articles of Association of the company and have further promised not to take any till the company declares dividend. I trust they will have the sympathy and co-operation of my countrymen to make this enterprise of my district a success.

UNIVERSITY COLLEGE OF SCIENCE,
92, UPPER CIRCULAR ROAD,
CALCUTTA.

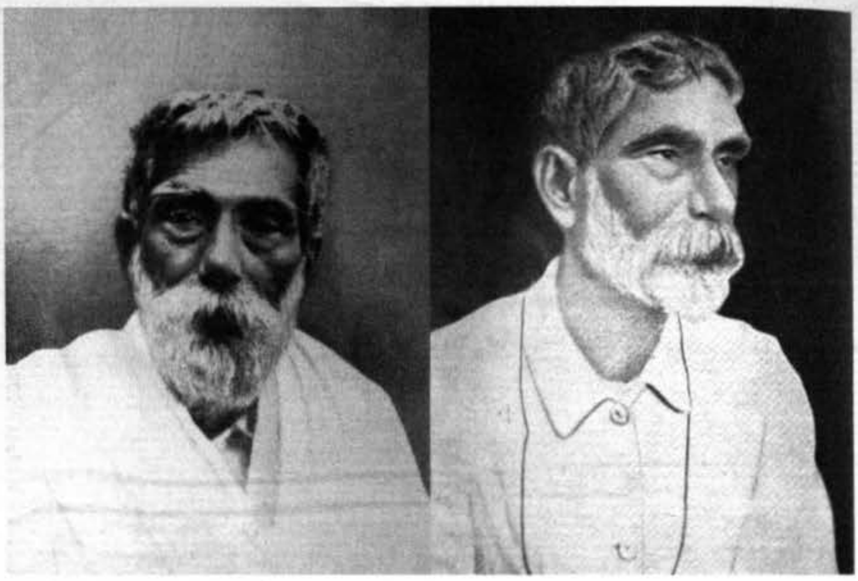
P. C. Ray
1-11-27.



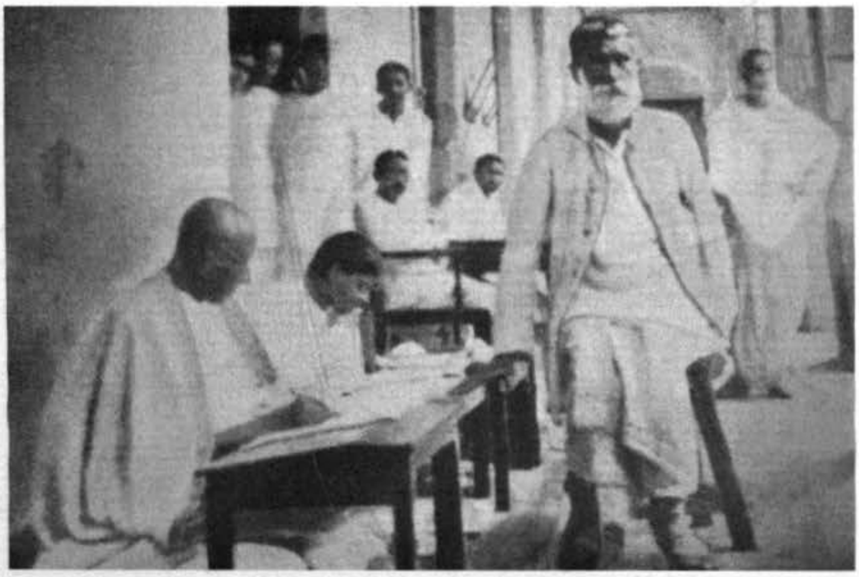
16. Bengal Chemical and Pharmaceutical Works Ltd.
Aerial view of Manicktala Factory (1931)



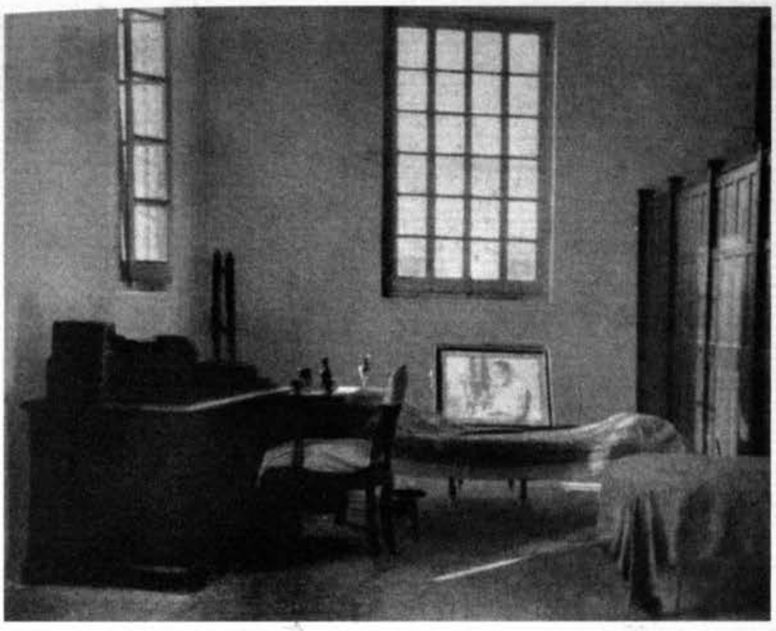
17. Bengal Chemical and Pharmaceutical Works Ltd.
General view of Panihati Factory (1951)



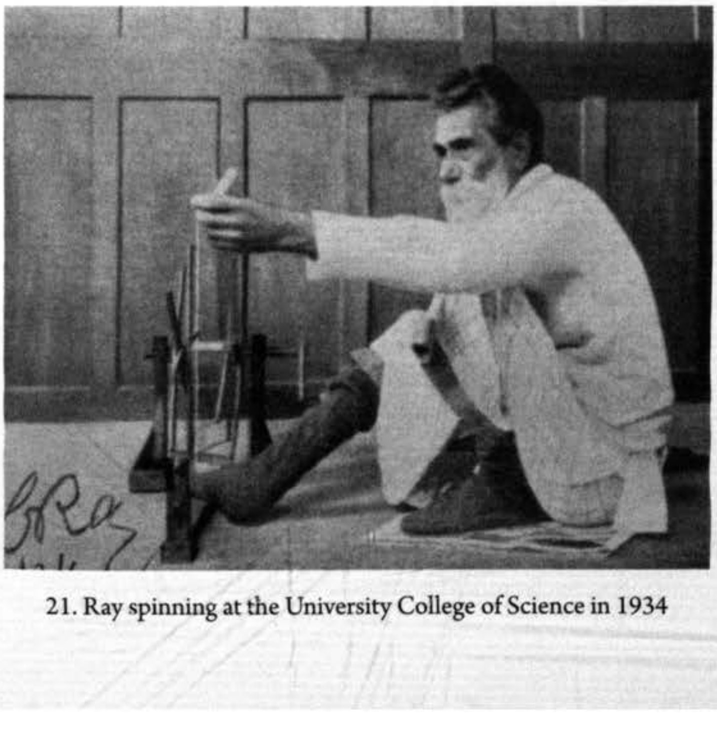
18. Ray in 1926 and 1932 respectively



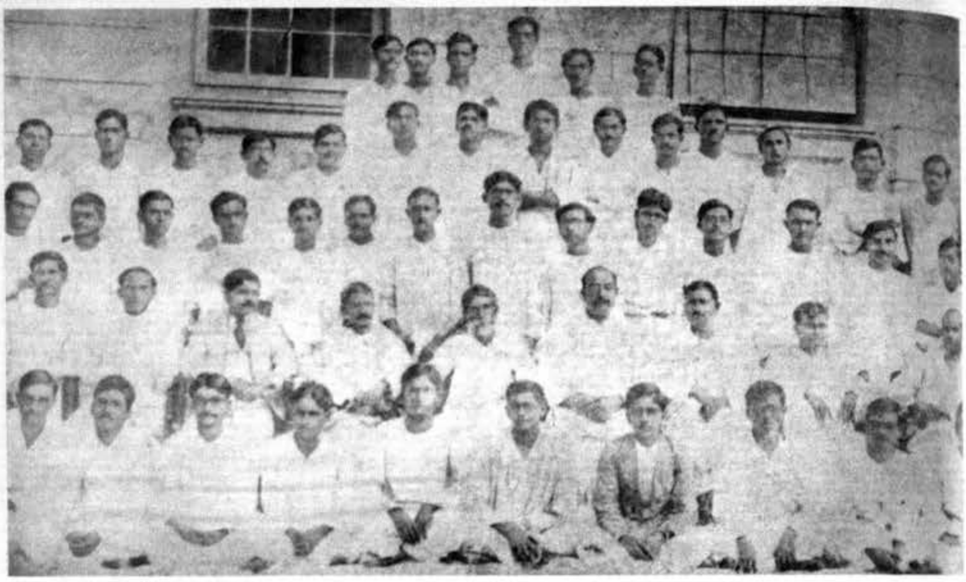
19. Ray with workers of Sankat Tran Samity in 1925



20. Ray's Living Room at the University College of Science

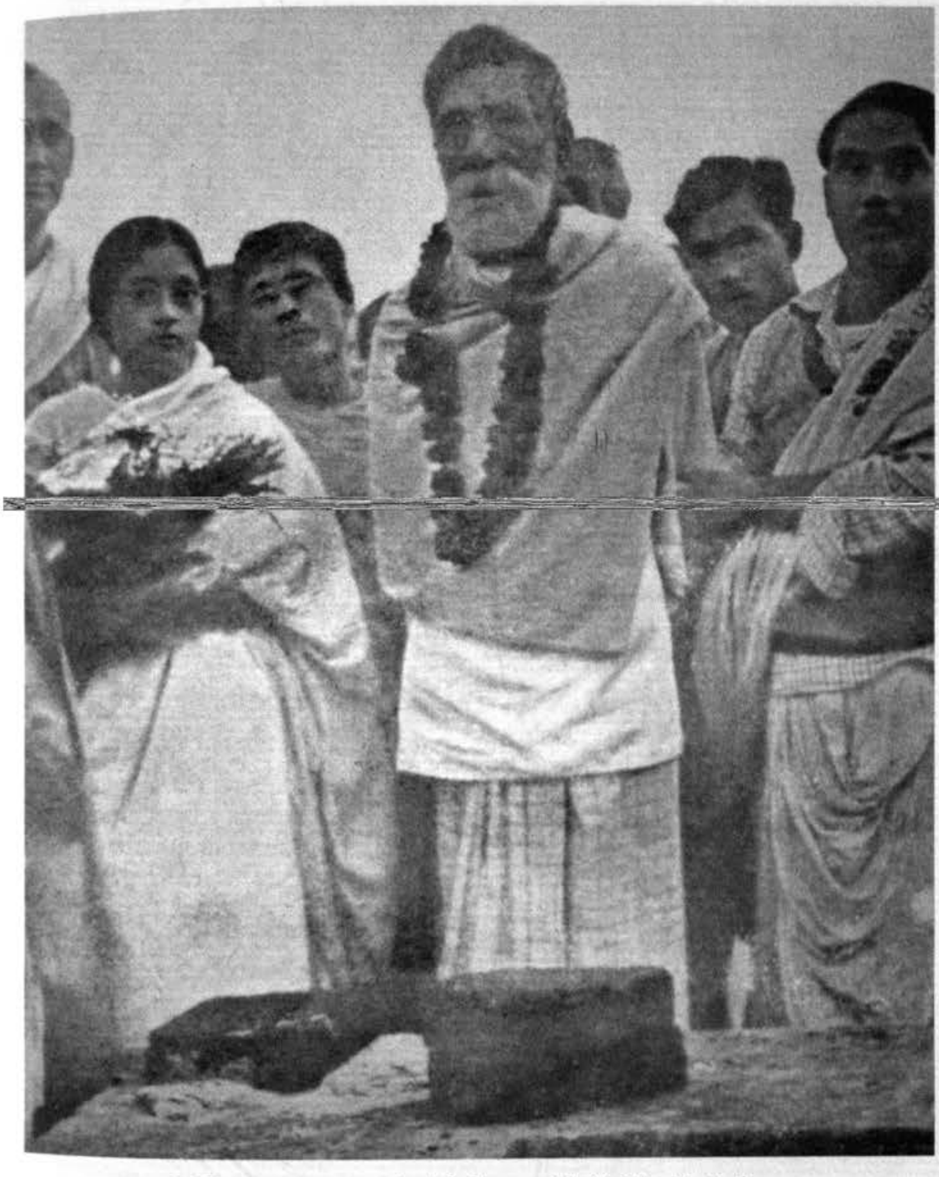


21. Ray spinning at the University College of Science in 1934



22. Ray with his colleagues and students at the University College of Science in 1928

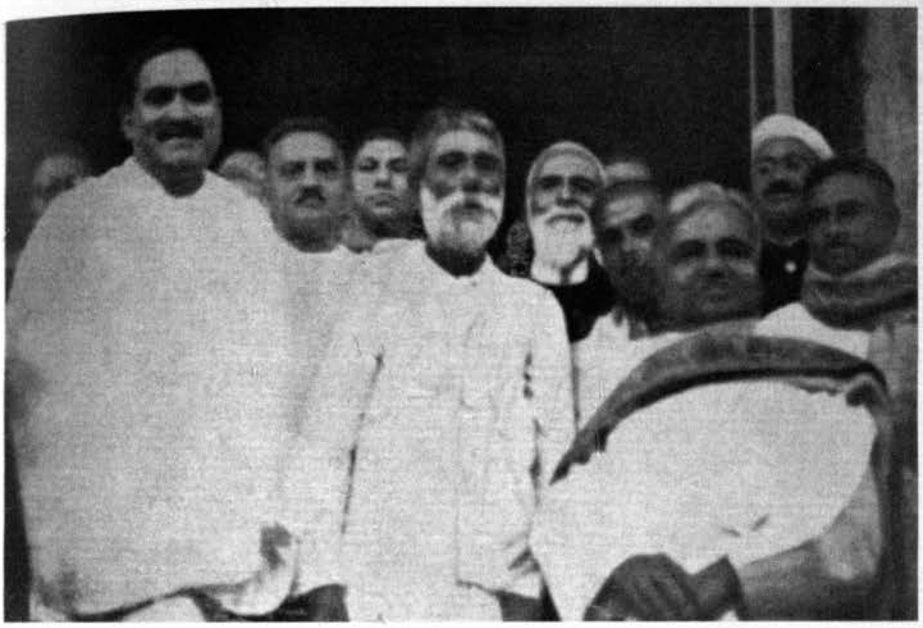
23. Ray, the Founder-President of Narikalyan Samity in 1929



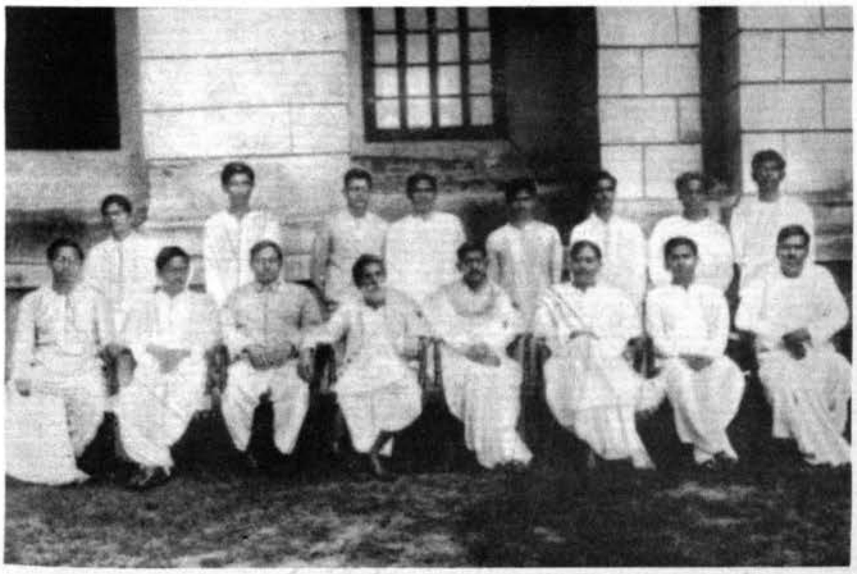
24. Ray inaugurating the Sahebnagar Krishi-Silpa Pratisthan, Nadia in 1930

25. Ray at the residence of Mahamahopadhyay Haraprasad Shastri on occasion of the latter's 80th birthday in 1932

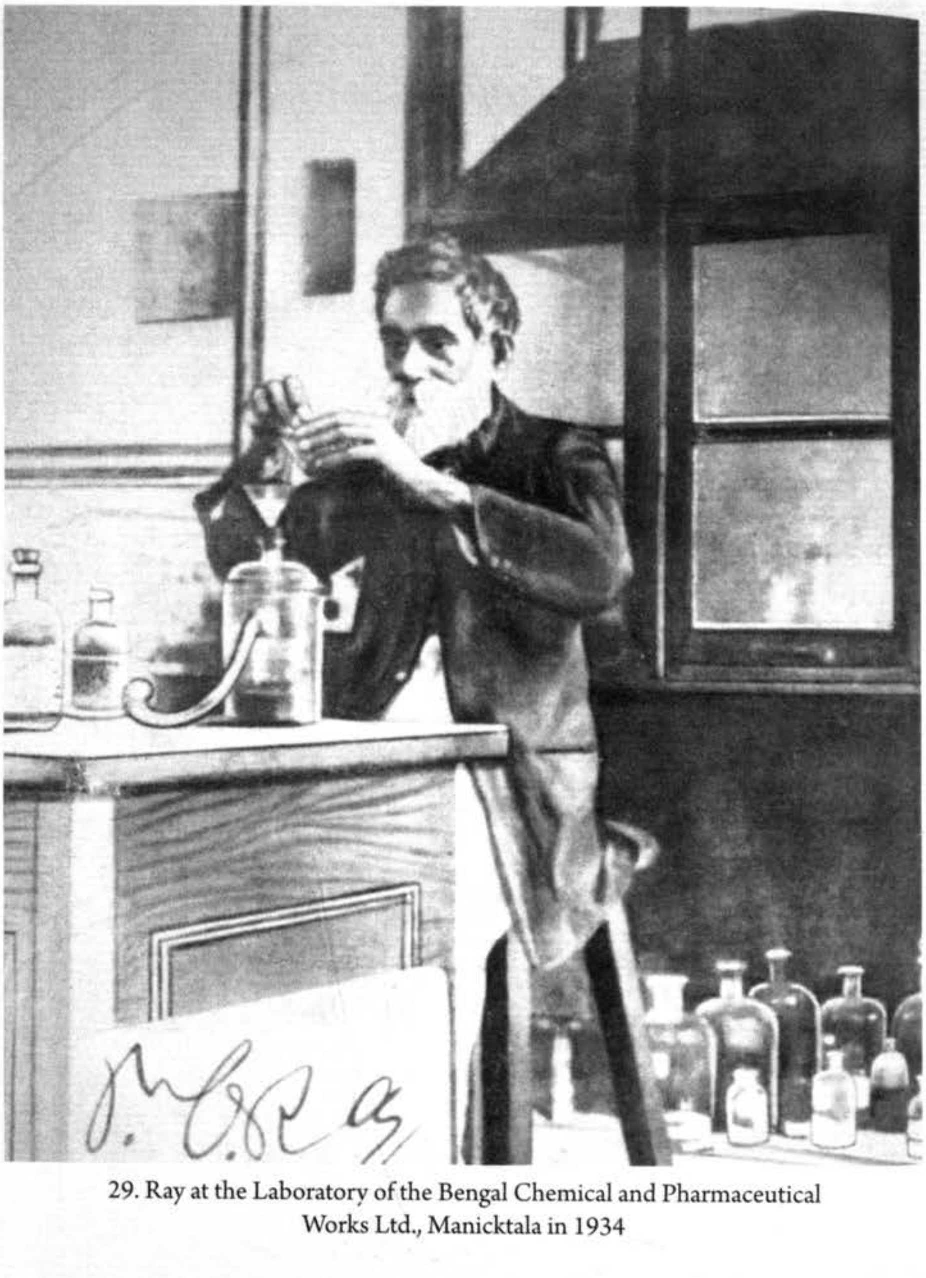
26. Ray at the Bengal Chemical and Pharmaceutical Works in 1932



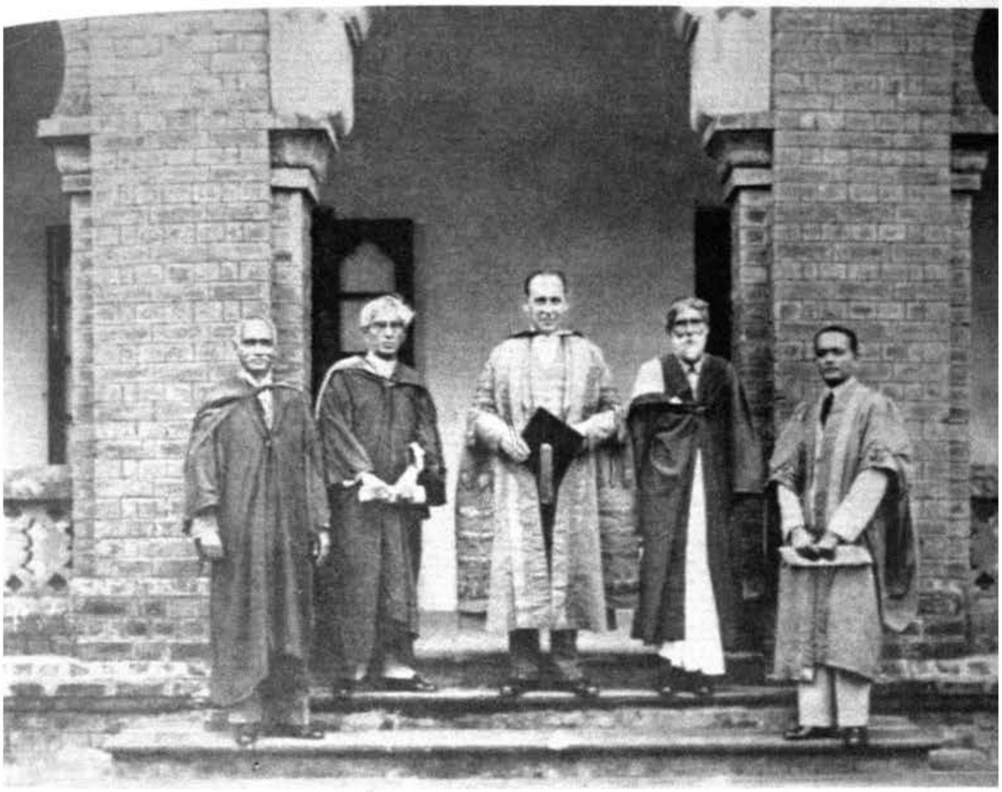
27. Ray given reception at the Town Hall on the occasion of his 70th birthday in 1932



28. Ray with the staff and students of the Physical Chemistry Department at the University College of Science in 1934



29. Ray at the Laboratory of the Bengal Chemical and Pharmaceutical Works Ltd., Manicktala in 1934

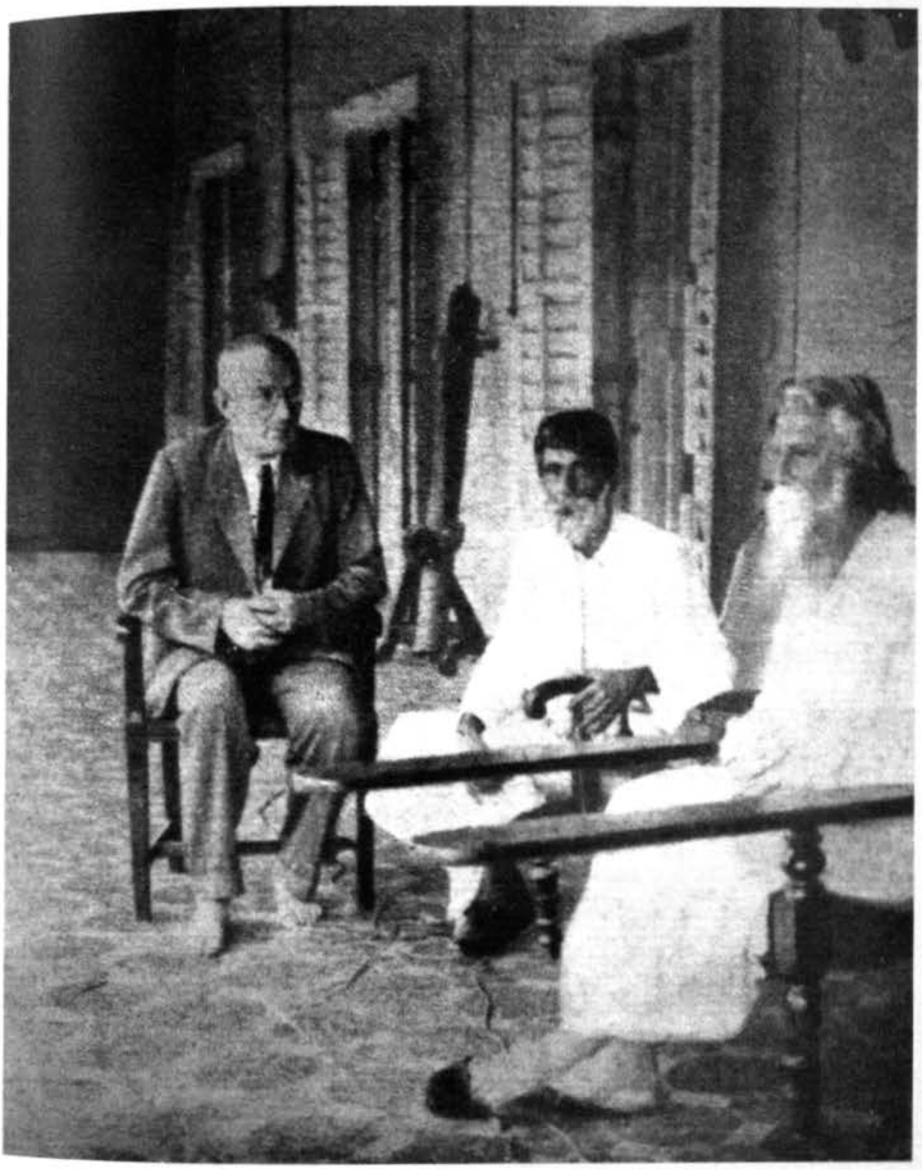


30. Ray after receiving the Honorary Degree of Doctor of Science at the Dacca Univeristy Convocation in 1934.

Standing (from Left to right): Sir Jadunath Sarkar, Dr. Saratchandra Chatterjee (novelist), Sir John Anderson (the Chancellor), Acharya Ray, Dr. A.F. Rahman (the Vice Chancellor)

31. Ray at Dacca in 1936

32. Ray at the Sadhana Oushadhalay in Dacca (1936)



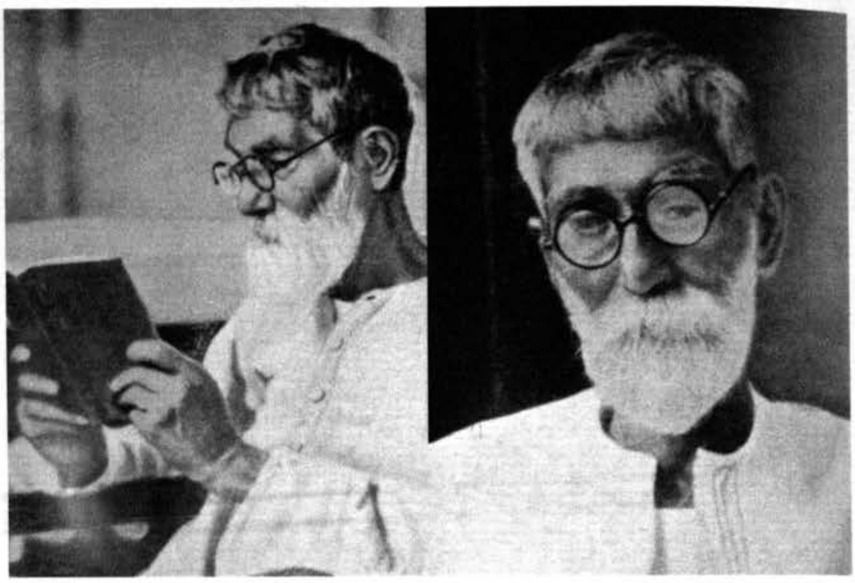
33. Ray with Rabindranath Tagore in 1937

34. Ray with the delegates of the Indian Science Congress on occasion of its Silver-Jubilee session in 1938

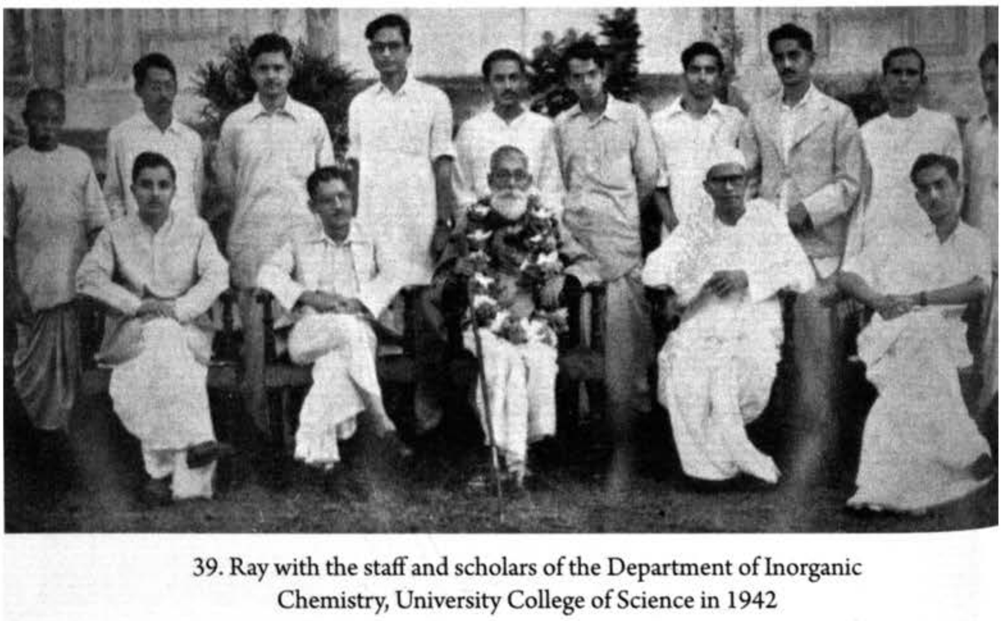
35: Ray in 1938 at the Science College after an operation on his left eye (Standing from left to right) Dr. P. N. Banerjea (Minto Professor), Acharya Ray, Dr. Azizal Haque (the Vice-Chancellor), Dr. Shyamaprasad Mookerjee

36. Ray with Justice Manmatha Nath Mukherjee at a function in 1940

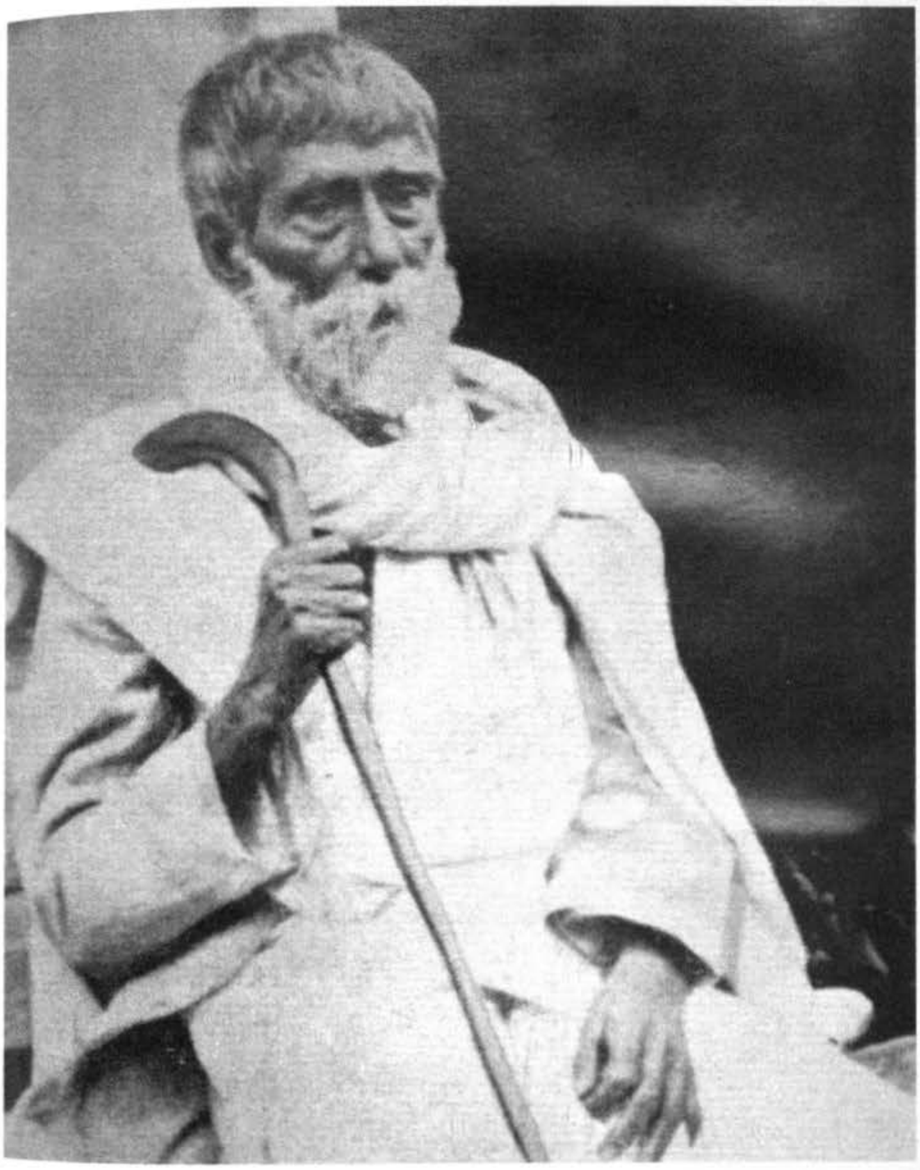
37. Ray at the Aryasthan Insurance Company in August 1942
on occasion of its 82nd Birth-Anniversary



38. Ray in 1941

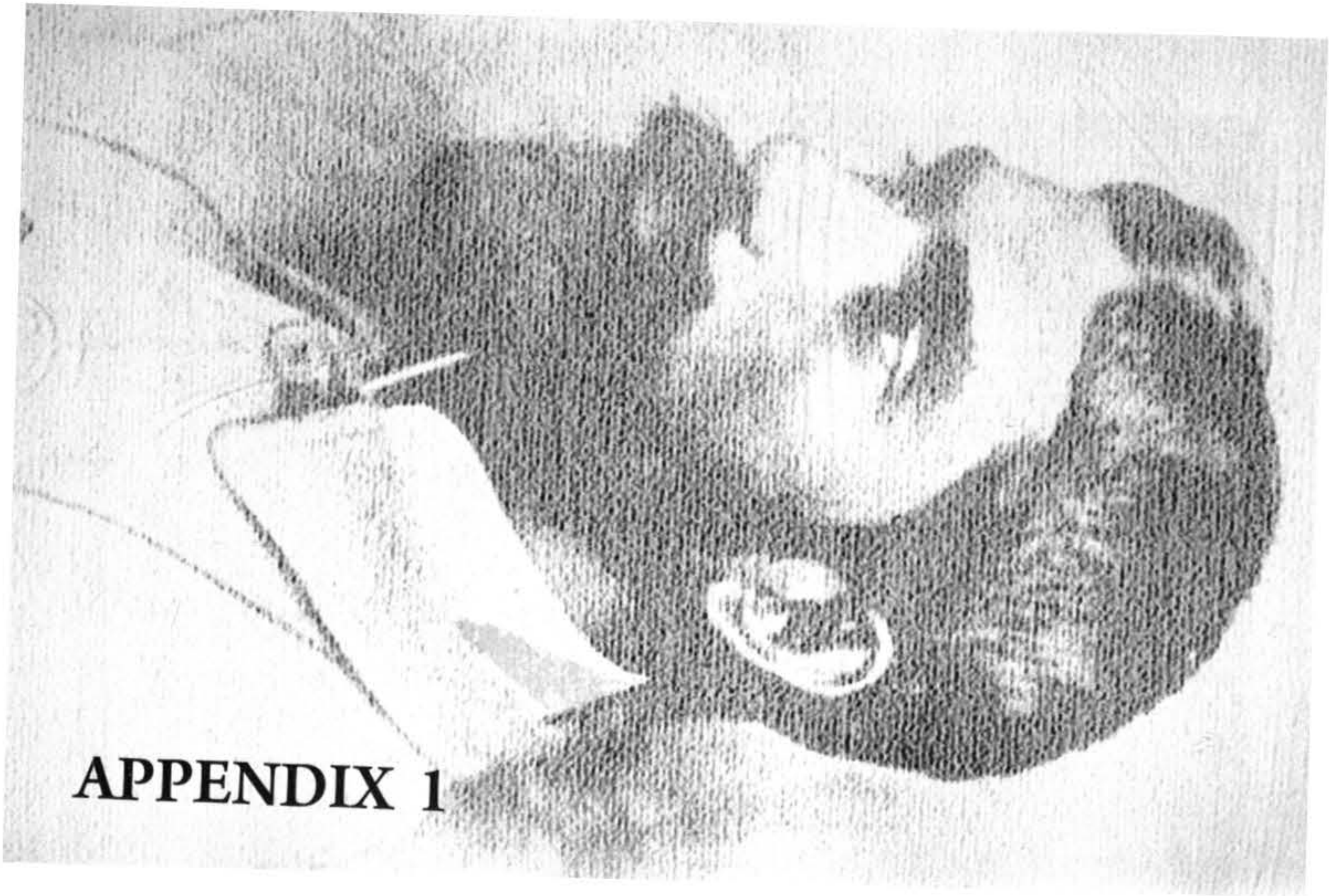


39. Ray with the staff and scholars of the Department of Inorganic Chemistry, University College of Science in 1942



40. Ray in 1941

APPENDIX 1



Praphullachandra Ray (1861-1944) A Brief Chronology

(A few publications are included because of their biographical significance, and a few because these are missing from the checklist of holdings. Research papers are listed in a separate appendix. Non-technical articles published in Bengali periodicals are excluded.)

1861: Born on 2 August in Raruli-Katipara in the district of Jasore (Jessore, now in Bangladesh) to Harischandra and Bhuvanmohini.

1866: Sent to local school.

1870: Moved with parents and elder brother to 132 Amherst Street, Kolkata.

1871: Admitted to Hare School, Kolkata.

1872-3: Suffered an attack of dysentery and returned to Raruli-Katipara.

1874: Admitted to Albert School, founded by Kesabchandra Sen, in Kolkata.

1875: Returned to Raruli-Katipara.

1876: Re-admitted to Albert School.

1878-9: Passed Entrance examination in the First Division.